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MEMOIRS
OF THE
GEOLOGICAL SURVEY OF INDIA.

Palæontologia Indica,

BEING

FIGURES AND DESCRIPTIONS OF THE ORGANIC REMAINS PROCURED DURING
THE PROGRESS OF THE GEOLOGICAL SURVEY OF INDIA.

PUBLISHED BY ORDER OF HIS EXCELLENCY THE GOVERNOR GENERAL OF INDIA IN COUNCIL,

UNDER THE DIRECTION OF

THOMAS OLDHAM, LL.D.,

Fellow of the Royal and Geological Societies of London; Member of the Royal Irish Academy;

Hon. Mem. of Leop-Carolino Academy of Natural Sciences: of the Isis, Dresden; of the

Roy. Geol. Soc., Cornwall: Corr. Mem., Zool. Soc., London, &c., &c.,

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Geological Survey of India.

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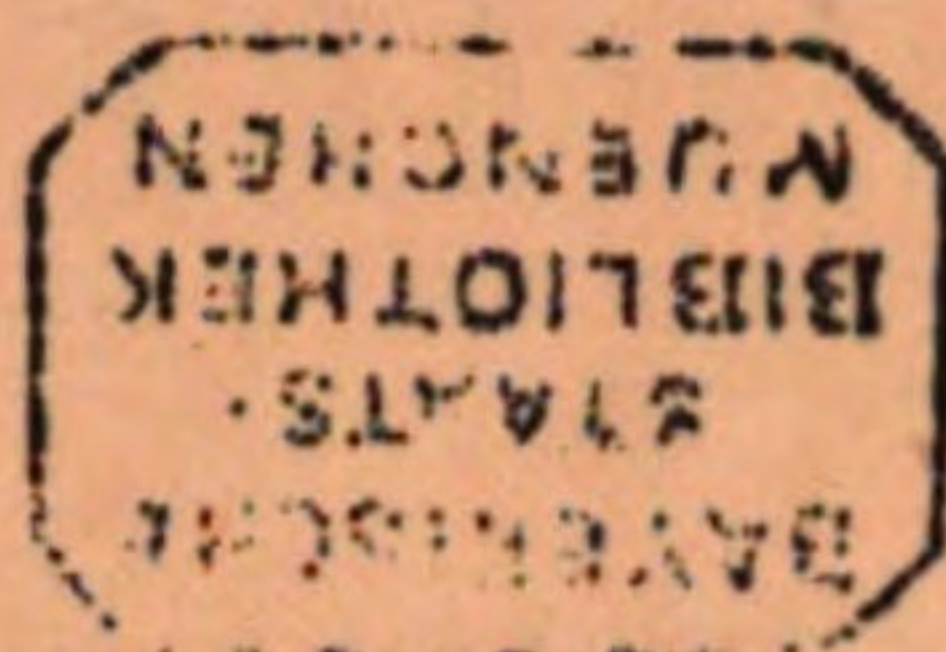
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Ser. X.

INDIAN TERTIARY AND POST-TERTIARY VERTEBRATA.

Vol. I.

Pt. i, 1874.—RHINOCEROS DECCANENSIS.—By R. B. FOOTE, F.G.S., *Geological Survey of India.*

Pt. ii, 1876.—MOLAR TEETH AND OTHER REMAINS OF MAMMALIA;

Pt. iii, 1878.—CRANIA OF RUMINANTS;

Pt. iv, 1880.—SUPPLEMENT TO CRANIA OF RUMINANTS;

Pt. v, 1880.—SIWALIK AND NARBADA PROBOSCIDA.—By R. LYDEKKER, B.A.,
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INDIAN TERTIARY AND POST-TERTIARY VERTEBRATA.

VOL. I.

PREFACE.

IN completing this first volume of the series of the "*Palæontologia Indica*," entitled "*Indian Tertiary and Post-Tertiary Vertebrata*," I avail myself of the opportunity afforded of making certain corrections and additions, which subsequent investigations have rendered necessary, in regard to some of the descriptions. I may mention that at the time of publication of the second fasciculus, there were contained in the Indian Museum only very fragmentary remains of many species, now represented by a much larger and more complete series: by the help of these more ample materials, I am now enabled in several cases to correct certain errors into which I had previously fallen. I may further add that had I had any idea, at the time of publication of that fasciculus, that the Indian Museum was at all likely to obtain such a magnificent collection of Siwalik vertebrate fossils as now enrich its cases, I should not have described remains of different orders in the heterogeneous manner in which they are there placed, but should have devoted a fasciculus to each order or sub-order, as has been subsequently done.

I cannot but regret that the execution of many of the plates in the second and third fasciculi is so poor; it was, however, the best that could be done at the time. A change in our arrangements has produced better results in the last fasciculus. Three of the worst of the earlier plates have been reissued with the fourth and fifth fasciculi.

In the references given below, and also in the index to the volume, the number of the pages refers to the continuous paging of the volume, and not to the separate paging of the five component parts.¹ The plates, with the exception of the first three, have the same heading, "*Tertiary Mammalia*," as forming one continuous series of illustrations of mammalian remains. The measurements given in this volume are all in inches and tenths.

¹ In the first fasciculus, there is of course only one system of paging; in the second, the volume numbering is at the bottom of each page; and in the succeeding parts, on the outer side of the part numbering.

The first fasciculus of this volume bears a different serial title from the succeeding fasciculi; this discrepancy is owing to the circumstance, that at the time of the publication of the first fasciculus, there was no idea entertained that the Indian Museum was likely to acquire the large collection of Siwalik fossils which are now exhibited in its cases.

In the introductory remarks to the second fasciculus, it was stated that the fourth fasciculus would be devoted to the description of the remains of Carnivora, and that a classified synopsis of the fossil Mammalia of South-Eastern Asia would be appended. Since the publication of the second fasciculus the collection of fossil Proboscidea in the Indian Museum has increased to such an unexpected extent, that it has afforded ample materials for a large fasciculus of itself: the collection of fossil Carnivora, on the other hand, is still very imperfect, and its description has accordingly been postponed: the publication of the synopsis has likewise been deferred.

No strict systematic arrangement has been adopted in the second, third, and fourth fasciculi, many of the specimens having been obtained while the work was still in progress, and described out of their proper serial succession: in the fourth fasciculus the same arrangement of the ruminants has been adopted as in the third, for convenience of reference. Similarly in the lists of ruminants given on pages 92 and 180, the same grouping has been adopted: the reader will understand, therefore, that the arrangement in those lists is in no wise a systematic one: in a systematic list the goats and sheep would of course be placed with the other *Cavicornia*. In the last fasciculus, where the materials were all at hand at the commencement of the work, a strictly systematic arrangement has been adopted.

RHINOCEROS DECCANENSIS.—Professor Flower¹ classes this species under the generic, or sub-generic, division *Atelodus*, in which are included the living *R. bicornis* and *R. simus* of Africa, and the fossil *R. pachygnathus*, *R. etruscus*, *R. leptorhinus*, *R. hemitechus*, and *R. tichorhinus* of Europe. The lower jaw figured in Plate LXXIV, fig. 6, of the "Fauna Antiqua Sivalensis," under the name of *R. sivalensis*,² seems also to indicate an animal belonging to the same group.

NARBADA RHINOCEROS.—A recent re-examination of the two upper molars of a rhinoceros from the pleistocene rocks of the Narbada valley, figured on Plate IV, figs. 5 and 6, of this volume, and described on page 32 under the name of *Rhinoceros namadicus*,³ has convinced me that these teeth are specifically indistinguishable from those of the living *R. indicus*, the very slight differences which I pointed out as existing between the recent and fossil last molars not being more than individual varieties. If, therefore, the similarity in the teeth can be relied on, we

¹ Proc. Zool. Soc., 1876, p. 457.

² Although in the text I have adopted Falconer's determination of the lower jaws of the Siwalik Rhinoceroses, I am quite unacquainted with the grounds on which such determinations were made.

³ The name *R. namadicus* of Falconer occurs in the introduction to the "Fauna Antiqua Sivalensis" (Pal. Mem., Vol. I, p. 21), and was, I believe, as stated in the sequel, applied to limb-bones from the Narbada.

have evidence of the existence of *R. indicus* in the pleistocene of India,¹ contemporaneously with the extinct mammals.

I cannot discover the history of the two molars under discussion: when I joined the Geological Survey, they, in company with other fossils, were in the Museum of the Survey and were labelled "Nerbudda valley." Both teeth are in a highly mineralised condition, and the earlier one (fig. 6), is embedded in a block of hard brown clayey sandstone, like many other Narbada specimens; I have therefore no doubt as to their origin.

An ultimate upper molar of *R. indicus* has been obtained by Mr. Foote from the alluvium of Madras, showing, in conjunction with the Narbada specimens, that the former geographical range of the species must have been very extensive.²

A right humerus of a fossil rhinoceros from the Narbada, in the collection of the Indian Museum, differs considerably in form from the corresponding bone of *R. indicus*, and would, therefore, seem to indicate the former existence of a second Narbada species. If the species should eventually turn to be distinct, the name of *R. namadicus* might be applied to it: the name is provisionally retained in the list of species of *Rhinoceros* given below, in order to mark the existence of a second Narbada species.

SIWALIK RHINOCEROTIDÆ.—Since the publication of the second fasciculus of this volume, in which the teeth of the Indian fossil species of *Rhinoceros* were treated of, as far as my materials then went, Professor Brandt³ has published a synopsis of the living and fossil species of *Rhinoceros*, in which he has arrived at conclusions, which appear to me unaccountable, in regard to Falconer's three species of Siwalik *Rhinoceros*. On page 39 of that memoir, *R. sivalensis* and *R. palæindicus* are considered as being specifically identical with *R. indicus* (*unicornis*); no reasons, however, are given for this union of the three species, except a vague remark of the late Mr. Blyth, to the effect that there is a great resemblance in the form of the skulls of the three forms. Professor Brandt appears to have entirely overlooked the characters of the molars of the three species. The molars of *R. indicus* are characterized by their complex structure, that is to say, they are furnished with a "combing-plate" and a "crochet," or, in other words, the second main internal column is connected with the outer wall of the tooth by a continuous ridge of enamel, and when the tooth becomes worn there are at least three islands, or fossettes, on the crown: further, the external surface of the tooth runs nearly parallel to the long axis of the crown and is not produced into a buttress at the antero-external angle. The three fossettes on the worn crown are situated nearly

¹ A single upper molar in the Indian Museum, collected by Mr. Hacket in the Narbada deposits, is indistinguishable from the corresponding tooth of the living *Cervus* (*Rucervus*) *duvaucellii*, indicating the existence of another living mammal in the pleistocene.

² I regret that the execution of the figures of the Narbada specimens is so defective, not giving at all a fair idea of their form.

³ Mem. de l'Acad. Imp. des. Sci. de St. Pet., Ser. VII, Vol. XXVI, No. 5.

in the same line, and parallel to the antero-posterior axis of the crown. In *Rhinoceros sivalensis*, on the other hand (as is well shown in the upper molar figured in Plate V, fig. 5 of this volume), there is no combing-plate, and the crochet is quite unconnected with the outer wall of the tooth; consequently when the tooth is worn down, there are normally not more than two fossettes¹ on the crown (as is well shown in fig. 5 of Plate LXXIV of the "Fauna Antiqua Sivalensis"), while the antero-external angle of the tooth is produced into a large buttress (shown well in my figure). The teeth of *R. sumatrensis* are of the same type, but that species is distinguished from *R. sivalensis* by having two horns in place of one horn.

The true molars and premolars of *R. palæindicus* (I am here doing little more than repeating the matter given in the text of this volume), likewise never have a combing-plate (though from specimens lately acquired by the Indian Museum, as well as from the young skull represented in fig. 1 of Plate LXXIV of the "Fauna Antiqua Sivalensis"), it appears that the milk-molars are, at all events sometimes, furnished with one. In the adult dentition (as is shown in fig. 2a of Plate LXXIV of the "Fauna Antiqua Sivalensis") there are normally three fossettes on the worn crown of each tooth, at some period of its wear: these three fossettes are not, however, placed in the same antero-posterior line, as in *R. indicus*, but the middle one is placed somewhat externally to the other two ("Fauna Antiqua Sivalensis", Plate LXXIV, fig. 2a, Plate LXXV, fig. 1), being cut off from the end of the main valley, and not from the hinder side of it. Finally, there is no distinct buttress in the true molars of *R. palæindicus* ("Fauna Antiqua Sivalensis," Plate LXXIV, fig. 2a) as in *R. sivalensis*, the outer surface of each molar being nearly flat in the former species. In treating of *Rhinoceros palæindicus* at page 24 of this volume, I noticed a young cranium of that species, which is figured in the "Fauna Antiqua Sivalensis" (Plate LXXIV, fig. 1), and of which there is a cast in the Indian Museum. In noticing this cranium in the description of the plate, Dr. Falconer observes: "Very perfect specimen of cranium with both zygomatic arches entire. Shows two molars and two posterior premolars on either side. The third molar is still in germ." From the mention of premolars by Dr. Falconer, it is quite evident that he considered the specimen as showing the permanent dentition, and in my notice of the cranium, I naturally followed this identification. If, however, we refer to the figure of the cranium in question in the "Fauna Antiqua Sivalensis," we shall see that the last tooth is less worn than the third, or any of the preceding teeth. On Falconer's supposition, the third tooth, being the first true molar, should have been more worn than the second tooth, or last premolar. Again, had the second tooth been the last premolar, and being as much worn as it is, the last true molar would have been in use; further, the first tooth is quite unlike a second premolar. From the above, it will be quite evident that the four teeth in Falconer's cranium really are the four milk-molars. There is therefore no abnor-

¹ A broken skull, probably belonging to this species, in the Indian Museum shows three fossettes on the two middle premolars, but none on the true molars or last premolar.

malinity in the dental series of this species, as was the case according to Dr. Falconer's supposition, and the permanent dental formula given on page 24 must now be made to stand as follows¹ :—

$$I. \frac{0-0}{1-1} \quad C. \frac{0-0}{0-0} \quad P. \frac{3-3}{3-3} \quad M. \frac{3-3}{3-3}$$

The table of measurements of the molars will also require the alteration of their names, and will read as follows :—

	In.
Length of 1st milk-molar	1.10
„ of 2nd „	1.65
„ of 3rd „	1.90
„ of 4th „	2.20
Width of 1st milk-molar	0.89
„ of 2nd „	1.50
„ of 3rd „	1.85
„ of 4th „	1.90

Professor Brandt, in identifying *R. sivalensis* with *R. palæindicus*, overlooks the above differences in the dentition, as well as the differences in the crania. *R. sivalensis* ("Fauna Antiqua Sivalensis," Plate LXXIII, fig. 2a) has the summit of the occiput and parietals raised to a much higher point than in *R. palæindicus* (*Ibid.*, fig. 1a); the interval between the nasals and maxillæ is much narrower in the former than in the latter; *R. palæindicus* is further distinguished by its broader forehead. Both species agree in being unicorn.

On page 44 of the same memoir, Professor Brandt classes the Siwalik *R. platyrhinus* with *R. sumatrensis*, in the genus, or sub-genus *Ceratorhinus* of Gray, apparently merely on the grounds that both species were furnished with two horns. Now, the molars of *R. platyrhinus* are of the complex type (as is explained in the text) of *R. indicus* and *R. tichorhinus*, and not of the simple type of *R. sumatrensis*. The descriptions given in the text will amply show the distinctness of the two species above mentioned, and there are now additional materials in the Indian Museum which still further illustrate the dentition of the fossil species, and which I hope to bring to notice on a future occasion. As evidence apart from the upper molars, the occurrence of three distinct forms of mandible of *Rhinoceros* (apart from *Acerotherium perimense*, which is also represented in the Indian Museum) in the Siwaliks, proves the existence there of three species, although their references to the three named species by Falconer (which I have accepted in the text) is very probably open to doubt. I have shown that *R. platyrhinus*, as regards its dentition, is nearest to *R. indicus*, and *R. sivalensis* to *R. sumatrensis*, which is precisely the reverse of the, what I cannot but call, arbitrary identifications of Professor Brandt. If characters like those of the teeth described in the sequel are to be completely ignored, both Zoology and Palæontology together would be impossible, and all the species of a genus might as well receive a single name. Professor Brandt

¹ The first milk-molar, which often persists, is not counted here in the permanent series.

makes no mention of the somewhat startling instance (according to his identifications) of a Miocene mammal (for *R. sivalensis* lived in the Miocene period in Sind) being identical with a living species, or, in other words, that *R. indicus* is a Miocene species, and was a contemporary of the long extinct *Dinotherium*, *Hyopotamus*, and *Anthracotherium*; *R. sumatrensis* being also, according to the same author, at least a Pliocene species. As far as I am aware, there are hardly any instances of newer Pliocene mammals being identical with living species, and even by far the greater number of the Pleistocene forms are extinct. I should be inclined to look very doubtfully on such pedigrees for the Indian rhinoceroses even, were they supported by strong evidence, which in the present case is conspicuous by its absence.

The small *Rhinoceros* tooth described on page 46 and drawn in fig. 10 of Plate VI of this volume, as a premolar of an undetermined species, I now think, in all probability, is an anterior milk-molar of *R. platyrhinus*.

In a recently published memoir on the fossil species of *Rhinoceros* and the allied families,¹ Professor Cope has placed *Rhinoceros sivalensis* in a distinct genus under the name of *Zalabis*.

This generic distinction is made on the strength of the statement originally made by Falconer, that this species was "hexaprotodont."² I have already shown in the text of this volume (p. 53), that the specimens figured in the "Fauna Antiqua Sivalensis" do not support this statement. In that work, there are figured three forms of lower jaws of Siwalik *Rhinoceros*, referred to the three named species, none of which are hexaprotodont, and of which the one referred to *R. sivalensis* has no incisors. None of the skulls of *R. sivalensis* with which I am acquainted show any upper incisors. I cannot, therefore, see that there is any evidence on which Professor Cope's new genus can be supported.³

The very different conclusions arrived at by Professors Brandt and Cope in regard to *Rhinoceros sivalensis*, afford subject for the most serious reflexions as to the present conditions under which palæontological research is carried on. In this case we find two eminent palæontologists, with precisely the same materials before them, arriving at the most opposite conclusions; Professor Brandt identifying *R. sivalensis* with a living species, and Professor Cope referring it to an entirely new genus! The former writer appears to have arrived at his conclusions from neglecting to notice the specific differences pointed out by other workers, while the latter has relied upon alleged differences which have been shown to be unsupported by any kind of tangible evidence. In both cases it was incumbent on the writers to have decidedly refuted all points which militate against their own conclusions, before instituting the sweeping changes which such conclusions involve.

¹ Bull. U. S. Geol. Geog. Surv., Vol. V, p. 232.

² Professor Cope reckons the outer lower tusk of *Rhinoceros* as a canine.

³ I may mention that on page 229 of his above quoted memoir, Professor Cope omits *Acerotherium perimense* from his list of that genus, *Rhinoceros iravadicus* from the genus *Rhinoceros*, and *R. deccanensis* from the genus *Atelodus*; Professor Cope also alludes to the Siwaliks as being undoubtedly of upper Miocene age!

If the lower jaw assigned to *R. sivalensis* in the "Fauna Antiqua Sivalensis" be rightly assigned, and if we admit the sub-divisions into which the old genus *Rhinoceros* is split up by many modern naturalists, *R. sivalensis* would seem from this point of view to belong to the genus *Atelodus* characterized by the symphysis of the mandible of the adult being edentulous, as in *Rhinoceros simus*. The skull of *R. sivalensis* is, however, unicorn, and, therefore, differs from that of *R. simus*. The species in fact, if the remains are rightly correlated, will not fit into any of the modern sub-divisions of the genus.

RHINOCEROS IRAVADICUS.—The fragment of a right maxilla of a species of *Rhinoceros* with two teeth described on page 45, and figured in Plate V, fig. 4, of this volume, which was not specifically determined, and the teeth in which were considered to be premolars, I now find to belong to a young individual with the milk-molar dentition. It appears probable that these milk-molars may have belonged to a young individual of *Rhinoceros iravadicus*, the permanent molars of which species are figured on the same plate: in having a combing plate they are more complex than the true molars.

ACEROTHERIUM PERIMENSE (*Rhinoceros planidens*).—As I have already mentioned in the "Records,"¹ the two imperfect upper molars of a rhinoceros figured on Plate IV, figs. 7 and 9, and described on page 41 of this volume, as belonging to a new species of *Rhinoceros*, under the name of *R. planidens*, really belong to *Acerotherium perimense* of Falconer and Cautley. The upper teeth of that species figured on Plate VI, figs. 2 and 5, as upper true molars, really are premolars, and the unnamed specimen represented in fig. 6 of the same plate is likewise an upper premolar of the same species.² The name of *R. planidens* must accordingly be erased from the list of Asiatic species of *Rhinoceros* given on page 52, and the description of its upper molars be read as those of *A. perimense*. In a subsequent volume I shall hope to illustrate more fully the dentition and craniology of the last named species: a cranium is now in the collection of the Indian Museum. As the teeth of this species, described on page 51 as molars, are really premolars, the statement as to the difference in shape of the molars of this species from the molars of *Rhinoceros* will consequently not stand.

It is at present unknown whether *Acerotherium perimense* was furnished with three or four digits to the forelimb, and from the condition in which Siwalik fossils usually occur, it is very improbable that this point will ever be determined. It is, therefore, impossible to say whether the species really belongs to *Acerotherium* or to the new genus *Aphelops* of Professor Cope,³ differing from *Acerotherium* in having only three anterior digits. I prefer provisionally to retain the species in the older genus.

¹ Vol. XII, p. 47.

² On page 44 I mentioned that I thought it possible this tooth should be referred to *R. planidens* (*A. perimense*). The cingulum is remarkably developed in this tooth, and causes it to resemble the premolars of *R. deccanensis*, as noticed in the description.

³ Bull. U. S. Geol. Geog. Surv., Vol. V, p. 236.

SPECIES OF ASIATIC RHINOCEROTIDÆ.—I append a few notes on the list of species of *Rhinoceros* given on page 52. Professor Brandt, in his memoir quoted above, admits *Rhinoceros inermis* of Lesson as a distinct species, which should, therefore, be added to the list. Professor Cope, in the above quoted memoir, suggests that this species should be referred to the genus *Aphelops*. Professor Brandt includes under *Rhinoceros javanicus* (*sondaicus*) both *R. nasalis* and *R. floweri* of Gray (the latter species classed as a synonym in my list). By the same writer *R. stenocephalus* of Gray is considered to have been founded on a young individual of *R. indicus* (*unicornis*). Again, under *Rhinoceros* (*Ceratorhinus*) *sumatrensis*, Professor Brandt includes *R. crossii*, *R. blythii*, and *R. niger* of Gray; the two former so-called species were omitted from my list, as being probably synonyms.

The following list of the recent and fossil species of *Rhinocerotidæ* of South-Eastern Asia is given to replace the one given on page 52, as embodying the more recent views. The synonymy of the existing species is given on the authority of Professor Brandt, and is taken from the memoir already cited. The name by which each species has been referred to in this volume is taken as the name of the species. The sub-generic (or generic) divisions of *Rhinoceros* (except *Acerotherium*) have been ignored, as they are, in many cases, inapplicable to the fossils, and the species have been arranged in alphabetical order; synonyms are in italics.

1. *Acerotherium perimense* (Falc. and Caut.) Mio-Pliocene. India and Burma.
Rhinoceros perimensis (Falc. and Caut.)
Rhinoceros planidens (*olim nobis*).
2. *Rhinoceros deccanensis* (Foote). Pleistocene. India.
3. *Rhinoceros indicus* (Cuv.) Recent and Pleistocene. India.
R. asiaticus (Blum.)
R. namadicus (*olim nobis*).
R. stenocephalus (Gray).
R. unicornis (Linné).
4. *Rhinoceros inermis* (Lesson). Recent. India.
5. *Rhinoceros iravadicus* (*nobis*).¹ Mio-Pliocene. Burma.
6. *Rhinoceros javanicus* (Gray). Recent. South-Eastern Asia.
R. floweri (Gray).
R. javanus (Cuv.)
R. nasalis (Gray).
R. sondaicus (Horsfield).
7. *Rhinoceros lasiotis* (Sclater). Recent. Malacca.
8. *Rhinoceros namadicus* (Falc. and Caut.) Pleistocene. India.
9. *Rhinoceros palæindicus*. (Falc. and Caut.) Mio-Pliocene. India.
10. *Rhinoceros platyrhinus* (Falc. and Caut.) Mio-Pliocene. India.
11. *Rhinoceros sinensis* (Owen). ? Pliocene. China.
12. *Rhinoceros sivalensis* (Falc. and Caut.) Mio-Pliocene. India.
R. indicus fossilis (Baker and Durand).
13. *Rhinoceros sumatrensis* (Cuv.) Recent. South-Eastern Asia.
R. blythii (Gray).
R. crossii (Gray).
R. niger (Gray).
R. sumatranus, (Raffles).

¹ The word *nobis* in this volume always refers to myself, and not to Mr. Foote.

SIWALIK ARTIODACTYLA DESCRIBED IN 2ND PART.—Since the publication of the second fasciculus of this volume, the list of Siwalik suine *Artiodactyla* has been considerably increased, and the list given on page 78 is consequently incomplete: to that list must now be added—

Sus punjabiensis.

Hyotherium sindiense.

Hyopotamus palæindicus.

Sivameryx.

Hemimeryx.

Chæromeryx silistrensis has also turned out to be distinct from *Anthracotherium silistrense*.¹

PALÆORYX.—Two upper molars in the Indian Museum, from the Siwaliks, seem to me to be in all probability generically identical with *Palæoryx* of the Pikermi beds of Attica.² I cannot, however, at present be quite certain of this determination, owing to the extreme difficulty of distinguishing the molars of many genera of ruminants.

PORTAX.—Some upper and lower jaws with ruminant teeth, from the Siwaliks, appear to me generically indistinguishable from those of *Portax*, and indicate a Siwalik representative of that genus.

PORTAX NAMADICUS (Rüt.). When noticing the additions made by Professor Rüttimeyer to the Indian fossil Ruminants,³ I had not observed the new Narbada species of *Portax* (*P. namadicus*) named by the Professor, from the hinder part of a skull in the British Museum.⁴ The addition of this species to the Narbada fauna is of great importance, as connecting the living and Siwalik species.

An atlas of a ruminant in the Narbada collection of the Indian Museum corresponds so exactly with the atlas of *Portax pictus* (except in being slightly larger) that I think it probably belongs to *Portax namadicus*. Two left molars of a ruminant, formerly in the Museum of the Asiatic Society of Bengal, and entered on page 255 of Falconer's catalogue of that collection, as being from the Narbada,

¹ I am now uncertain of the generic distinctness of *Hippopotamodon*.

² "Animaux fossiles et Géologie de l'Attique," Plate XLVII.

³ pp. 178-180.

⁴ "Die Rinder der Tertiär-Epoche, &c.," p. 89, Plate VI, figs. 7 and 8. I hope Professor Rüttimeyer will pardon me if I mention the inconvenience which arises from first mentioning the name of a new species in the midst of a paragraph, as he has done in this case. The description of every new species ought to have a distinct heading, by which it at once catches the eye. In the case of *Portax namadicus* not at first having time to read Professor Rüttimeyer's memoir through, the name of this species, from appearing in the middle of a sentence, did not catch my eye until I had time for a more leisurely perusal of the work. Dr. Gray uses the name *Portax picta* for the living species, which also occurs in a former part of this volume; the Greek word Πόραξ, a young bovine animal, is, however, either masculine or feminine, and the former gender should have the preference. Hence *Portax pictus*, as given by Jerdon and *P. namadicus*, by Rüttimeyer, are correct.

and doubtfully referred to the genus *Cervus* (No. N, 68), I have carefully compared with the corresponding teeth of *Portax pictus*, and find that the two are generically indistinguishable, and I therefore come to the conclusion that the fossil teeth probably belong to *Portax namadicus* of Professor Rüttimeyer. Similar teeth have been obtained by Mr. Hacket from the Narbada, and by Mr. Fedden from the Pem-ganga.

BOVIDÆ.—Among Mr. Theobald's Siwalik collection, I have lately determined two specimens of the axis vertebræ of a bovine, which, from their large size, must, I think, undoubtedly belong to *Bos acutifrons*. I have compared these vertebræ with a perfect specimen of the axis of *Bos primigenius* in the Indian Museum, and with another specimen figured by Professor Rüttimeyer,¹ and I find that although the Indian and European vertebræ are similar in general plan, yet there are many points of detail in which they differ considerably, thus confirming my conclusions drawn from the skulls.

It may be well to mention here that at the time of writing the third fasciculus of this volume,² I was unacquainted with the fact that some varieties of *Bos primigenius* have horn-cores with an elliptical cross section at the base, as the specimen drawn in fig. 3 of Plate II of the above-quoted memoir of Professor Rüttimeyer. In this respect, therefore, there is a closer relationship between *Bos primigenius* and *B. planifrons* and *B. acutifrons* than I have indicated in the text.

It should also be observed that Professor Boyd Dawkins³ drops the name *Bos primigenius*, and identifies that animal with the prehistoric and historic *Bos urus*, now represented by the cattle of Chillingham Park. By Professor Rüttimeyer, in his last published memoir,⁴ the name *Bos primigenius* is retained for the Pleistocene form, and the name *Bos taurus* adopted (as a race name) for the living form.

With regard to the bisons, Professor Rüttimeyer has come to the conclusion that the bones of *Bison priscus* are indistinguishable from those of *Bison americanus*, while, on the other hand, *Bison priscus* and *B. europæus* are also indistinguishable specifically.⁵ There is thus established an intimate connection between the now widely different European and American bisons. In his latest work, however, Professor Rüttimeyer⁶ retains the three above mentioned specific names, and places *B. sivalensis* as the earliest representative of the group.

The genus *Bubalus* of other writers is split up by Professor Rüttimeyer into two genera,⁷ which are termed *Bubalus* and *Buffelus*; the former includes the European Pleistocene *B. antiquus* and the living African *B. caffer* and *B. brachyceros*; the latter includes *B. platyceros* (*sivalensis*), *B. palæindicus*, and *B. pallasii* in the Pleistocene. In the recent period Professor Rüttimeyer names the living Indian

¹ Nov. Mem. Soc. Helv., Vol. XIX, Pl. IV, figs. 1, 2.

² See page 112.

³ Quar. Journ. Geol. Soc., Lond., Vol. 22, p. 394.

⁴ "Die Rinder der Tertiär-Epoche, etc.," p. 189.

⁵ See "Prehistoric Times," 2nd ed., p. 296.

^{6, 7} loc. cit.

buffaloe, *Buffelus indicus*: this name is, of course, synonymous with the name *Bubalus buffelus* adopted by Gray,¹ and *B. arni*, adopted in this volume, after Jerdon.²

Professor Rütimeyer also mentions another, apparently Indian species, under the name of *Buffelus sondaicus*.

The genus *Bibos*, according to Professor Rütimeyer, includes the domestic Indian cattle, *B. indicus*, the Gour, *B. gaurus*, a doubtful species named *B. gavæus*, and *B. sondaicus* (*banting* of Gray and this work). *Bibos frontalis* (the Mithun or Gayal) of Lambert and Hodgson is omitted from the list, unless it be *B. gavæus*. Whether or no the Mithun occurs now in the wild state or not, it appears to me to be a distinct species, though there are some skulls in the Indian Museum which bridge over the gap between this animal and the typical Gour.

CERVUS.—A palatal portion of a skull containing teeth similar to those figured on Plate VIII, fig. 3, under the name of *Cervus simplicidens*, seems to confirm the generic identification of those teeth. Of *Cervus triplidens* (figs. 1, 2, Plate VIII) I have not obtained any additional specimens, but I think the generic identification is here also correct. One of the Siwalik deer had flattened and branching antlers much like those of *Cervus duvaucellii*, indicating the high state of evolution of the group in Siwalik times.

The Indian Museum has lately obtained a complete maxilla, containing molars like the one tooth drawn in figs. 7 and 10 of Plate VIII. I had some hesitation, as noticed in the text, in referring the figured tooth to *Cervus*, and I still am not quite sure whether such reference is correct, though I think it very possibly is. The amount of variation in the form of the molars of the *Cervidæ* is so great that it is very difficult to say, in the case of isolated teeth, how far this variability may extend. I have, on account of the possibility of doubt, not included *Cervus latidens* in the list of ruminants given on page 180. I hope eventually to obtain materials which will decisively indicate the genus of the teeth in question.

The lower molars of a *Cervus* drawn in fig. 5 of Plate VIII, which I thought might possibly belong to *C. simplicidens*, I now find, from the character of their enamel, belong, in all probability, to a new species, which I propose, on a subsequent occasion, to call *C. sivalensis*.

PALÆOMERYX.—A single tooth of a ruminant from the Siwaliks, lately presented to the Indian Museum by the Roorkee (Rūrki) Museum, seems to belong to *Palæomeryx*, and to have been about the size of *P. bojani*: this tooth seems to have come from the lower Siwaliks (Nahans), and a lower molar from probably the same horizon in Sind, not impossibly belongs to the same genus.

CAMELOPARDALIS.—A more complete lower jaw of *Camelopardalis sivalensis* than the one of which the molars are drawn in fig. 5 of Plate VII of this volume has lately been acquired by the Indian Museum; the new specimen is

rather smaller than the figured one. A large series of molars of this genus have also been obtained which seem to indicate the existence of other Siwalik species.

VISHNUTHERIUM.—Two associated upper molars of a sivatheroid from the Siwaliks of the Punjab, present characters which distinguish them from the molars of *Sivatherium*, *Bramatherium*, and *Hydaspietherium*; from the size, and certain details of the form of these teeth, I have thought it not impossible that they may belong to *Vishnutherium iravadicum*, of which the lower molars are figured in Plate VII, figs. 1 and 2.

HYDASPITHERIUM MEGACEPHALUM.—It is possible that some critic may say that the specific name of this species is a barbarism, and, therefore, should be replaced. The name *megacephalum* is undoubtedly a barbarism, but the termination appears to have gained general acceptance as a convenient adjectival form for scientific names. The Greek substantive Κεφαλή if translated into Latin, should probably be *Cephala*, and the only direct adjectival form is Κεφαλωτός; by naturalists, however, a latinised adjectival termination, *Cephalus*, -a-um, is in common use; e. g., *Plesiosaurus brachycephalus*, *Halcyon leucocephala*, *Ptychozoon homalocephalum*. The term *megacephalum* is used for brevity in place of *megaloccephalum*, on the precedent of *Megatherium* for *Megalotherium*.

HELLADOTHERIUM.—M. Gaudry¹ states that *Helladotherium* occurs in India. I am not aware on what grounds this statement rests.

These additional specimens will afford ample material for another memoir, illustrative of Siwalik ruminants and their allies.

TETRACONODON MAGNUM.—Since publishing (p. 79) the description of the imperfect mandible figured on Plate X, I have discovered the two last molars belonging to that specimen, which had previously been mixed up with some other specimens. As the execution of Plate X was very poor, I take the opportunity of re-issuing that plate with one of the newly found teeth in its proper serial position. To the measurements of the molars of the figured specimen given on page 80 must be appended, "length of last molar 1.95 inches, width of ditto 1.3 inches." This tooth shows that Falconer's specimen belonged to the upper jaw.

CONCLUSION.—The above additions and corrections will, I hope, render the contents of this volume correct, as far as my present knowledge goes. European palæontologists will, I hope, pardon many shortcomings and redeterminations in my work, which have been in many cases almost unavoidable. The work of a student in vertebrate palæontology in India is one of peculiar difficulty in many ways. He has first of all the difficulty, common to workers in other countries, of having very frequently exceedingly imperfect and scanty remains from which to determine the affinities of an animal, and is consequently liable to false inferences from this source. *Secondly*, he feels the want of a large collection of the remains of described European species of vertebrates for comparison: it is true the Indian Museum in Calcutta possesses a

¹ "Les Enchainements du Monde Animal, Mammifères Tertiaries," p. 79.

considerable collection of casts and remains of non-Indian fossil vertebrates, but these really comprehend only a few of the better known genera.¹ *Thirdly*, although the library of the Geological Survey is an extensive one, there are wanting a great number of the older works on vertebrate palæontology, many of which are now out of print: in many cases, moreover, works, when ordered from England, arrive in India too late for the purposes of the worker who required them. *Fourthly*, the student in Indian vertebrate palæontology at the present time labours under the great disadvantage of working without the possibility of appealing to other workers in the same branch of study for assistance and advice in cases of doubt and difficulty. There are also wanting in the zoological department of the Indian Museum skulls of many genera of living mammals which are required for an exhaustive comparison of their fossil congeners. *Finally*, in the case of Siwalik fossils, there occurs the additional and special difficulty of taking up the work in the incomplete state it was left at the premature death of Dr. Falconer, and of determining ill-defined, imperfectly described species in Calcutta, without access to the original specimens in London. This last difficulty has been the cause of several errors in the specific determinations which occur in this volume.

On the above grounds, I venture to hope that any want of references or comparisons to European fossils, and consequent possible shortcomings in this work, will be looked upon with a lenient eye by my European and American fellow workers.

In conclusion, it is but fair to mention that although there has devolved upon myself the task of describing the Siwalik fossils in the Indian Museum of Calcutta, yet that the far more onerous task of amassing and bringing together that, perhaps, unrivalled series has devolved upon my colleagues in the Geological Survey, chief among whom are Messrs. W. T. Blanford, F. Fedden, W. Theobald, and A. B. Wynne. By far the largest share of this work has been executed through the indefatigable energy and perseverance of Mr. Theobald, who, through heat and cold, drought and rain, has traversed many a weary mile of the hills and plains of the Punjab to attain his object: to him especially are due the thanks of all interested in the history of the tertiary vertebrates of India.

R. LYDEKKER.

INDIAN MUSEUM, }
Calcutta, January 1880. }

¹ I have the authority of the Superintendent of the Geological Survey of India to offer named duplicate specimens of described Siwalik fossils in exchange for named specimens of teeth of European or American tertiary mammals.

LIST OF PLATES.

PLATE.

- I.—RHINOCEROS DECCANENSIS, (Foote.)
- II.—DITTO.
- III.—DITTO.
- IV.—RHINOCEROS, sp. var.
- V.—DITTO.
- VI.—DITTO.
- VII.—AMPHICYON, BRAMATHERIUM, CAMELOPARDALIS, DORCATHERIUM, VISHNUTHERIUM.
- VIII.—CERVUS, LISTRIODON, MANIS.
- IX.—DINOTHERIUM PENTAPOTAMÆ, (Falc.) SANITHERIUM SCHLAGINTWEITII, (Meyer.)
- X.—TETRACONODON MAGNUM, (Falconer.)
- XI.—BOS NAMADICUS, (Falc. & Caut.)
- XII.—BOS ACUTIFRONS, (Nobis,) BOS PLANIFRONS, (Nobis.)
- XIII.—BOS ACUTIFRONS, (Nobis.)
- XIV.—BOS PLATYRHINUS, (Nobis.)
- XV.—BISON SIVALENSIS, (Falc. & Caut. sp.)
- XVI.—BOS, sp. var.
- XVII.—BISON SIVALENSIS, (Falc. sp.) BUBALUS PALÆINDICUS, (Falc. & Caut.)
- XVIII.—BUBALUS PLATYCEROS, (Nobis.)
- XIX.—BUBALUS PALÆINDICUS, (Falc. & Caut.)
- XX.—HEMIBOS OCCIPITALIS, (Falconer sp.) ♂ (Described in third fasciculus as *Peribos occipitalis*).
- XXI.—HEMIBOS OCCIPITALIS, (Falconer sp.) ♂ (Same specimen as in last plate).
HEMIBOS ACUTICORNIS, (Falconer sp.) ♀ (Described in third fasciculus as *Amphibos*).
- XXI A.—HEMIBOS OCCIPITALIS, (Falc. sp.) ♂
- XXI B.—HEMIBOS ACUTICORNIS, (Falc. sp.) ♀
- XXII.—HEMIBOS ACUTICORNIS, (Falc. sp.) ♂ (Described in third fasciculus as *Hemibos triquetriceros*).
- XXIII.—HEMIBOS ACUTICORNIS, (Falc. sp.) ♂ (Same specimen as in last plate).
- XXIII A.—HEMIBOS ACUTICORNIS, (Falc. sp.) ♀
- XXIV.—HEMIBOS OCCIPITALIS, (Falc. sp.) ♂ (Described in third fasciculus as *H. triquetriceros*).
- XXV.—ANTILOPE SIVALENSIS, (Nobis,) A. PATULICORNIS, (Nobis,) A. PORRECTICORNIS, (Nobis.)

PLATE.

- XXVI.—HYDASPITHERIUM MEGACEPHALUM, (Nobis.)
 XXVII.—HYDASPITHERIUM MEGACEPHALUM, (Nobis,) SIVATHERIUM GIGANTEUM, (Falc. & Caut.)
 XXVIII.—CAPRA SIVALENSIS, (Nobis,) C. PERIMENSIS, (Nobis,) CAPRA, sp.
 XXIX.—DINOTHERIUM PENTAPOTAMIÆ, (Falconer.)
 XXX.—DITTO.
 XXXI.—DINOTHERIUM, sp. var.
 XXXII.—MASTODON FALCONERI, (Nobis.)
 XXXIII.—DITTO.
 XXXIV.—MASTODON PANDIONIS, (Falconer.)
 XXXV.—DITTO.
 XXXV A.—DITTO.
 XXXVI.—DITTO.
 XXXVII.—MASTODON LATIDENS, (Clift.)
 XXXVIII.—DITTO.
 XXXIX.—DITTO.
 XL.—MASTODON PERIMENSIS, (Falc. & Caut.)
 XLI.—MASTODON PERIMENSIS, (Falc. & Caut.,) MASTODON SIVALENSIS, (Falc. & Caut.)
 XLII.—MASTODON PERIMENSIS, (Falc. & Caut.)
 XLIII.—DITTO.
 XLIV.—MASTODON SIVALENSIS, (Falc. & Caut.)
 XLV.—STEGODON CLIFTII, (Falc. & Caut.,) S. BOMBIFRONS, (Falc. & Caut.,) S. INSIGNIS, (Falc. & Caut.)
 XLVI.—STEGODON BOMBIFRONS, (Falc. & Caut.,) S. INSIGNIS, (Falc. & Caut.)

LIST OF ABBREVIATIONS USED, AND WORKS AND MORE IMPORTANT MEMOIRS QUOTED IN THIS VOLUME.

- "Abhand. der k. k. Geol. Reich." = "Abhandlungen der k. k. Geologischen Reichsanstalt," *q. v.*
 "Abhandlungen der k. k. Geologischen Reichsanstalt," Wien.
 "Abhandlungen der Schweizerischen paläontologischen Gesellschaft," Basel.
 Adams, A. L. "Dentition and Osteology of *Elephas antiquus*." *Palæont. Soc.*, 1877.
 ——— "Dentition and Osteology of *Elephas primigenius*." *Palæont. Soc.*, 1879.
 ——— "Maltese Fossil Elephants." *Trans. Zool. Soc., Lon.*, Vol. IX.
 "Addenda and Corrigenda to Paper on Tertiary Mammalia," Lydekker, *R. G. S. I.*, Vol. IX, p. 154.
 "Amer. Jour. Science and Art" = "American Journal of Science and Art," *q. v.*
 "American Journal of Science and Art," New Haven.
 "Anatomy of Vertebrates," Owen, London, 1866-68.
 "Ancient Ruminant Fauna of Switzerland" = "Die Fauna der Pfahlbauten in der Schweiz," *q. v.*
 "Animaux Fossiles et Géologie de l'Attique," Gaudry, Paris, 1862-67.
 "Ann. Mag. Nat. Hist." = "Annals and Magazine of Natural History," *q. v.*
 "Annals and Magazine of Natural History," London.
 "Arch. du Mus. d'Hist. Nat. de Lyon" = "Archives du Museum d'Histoire Naturelle de Lyon."
 "Archives du Museum d'Histoire Naturelle de Lyon," Lyons.
 "Asiatic Researches," Calcutta.
 Baker and Durand: "Mémor on sub-Himalayan fossils." *J. A. S. B.*, Vol. V, p. 490.
 Bettington: "Mémor on certain fossils, more particularly a new Ruminant, found at the Isle of Perim, in the Gulf of Cambay." *Jour. Roy. As. Soc.*, Vol. VIII, p. 340.
 Blainville: "Ostéographie des Mammifères," Paris, 1839-64.
 Blanford and Medlicott: "Manual of Geology of India," Calcutta, 1879.
 Blum. = Blumenbach.
 Brandt: "Tentamen Synopseos Rhinocerotidum viventium et fossilium." *Mem. de l'Acad. Imp. des. Sci. de St. Pet.*, Ser. 7, Vol. XXVI, pt. 5.
 "British Fossil Mammals" = "History of British Fossil Mammals and Birds," *q. v.*
 "British Fossil Mammals and Birds." = "History of British Fossil Mammals and Birds," *q. v.*
 "British Museum Catalogue of Ungulates" = "Catalogue of specimens of Mammalia in the British Museum, pt. III, Ungulata," *q. v.*
 "Bulletin of the United States Geological and Geographical Survey of the Territories." Washington.
 "Bul. U. S. Geol. Geog. Surv." = "Bulletin of the United States Geological and Geographical Survey of the Territories," *q. v.*
 "Catalogue of A. S. B." = "Catalogue of the Fossil Remains of Vertebrata in the Museum of the Asiatic Society of Bengal," *q. v.*
 "Catalogue of specimens of Mammalia in the British Museum, pt. III, Ungulata," Gray, London, 1852.
 "Catalogue of Ruminants" = "Hand-list of the Edentate, Thick-skinned, and Ruminant Mammals in the British Museum," *q. v.*
 "Catalogue of the Fossil Remains of Vertebrata in the Museum of the Asiatic Society of Bengal," Falconer and Walker, Calcutta, 1859.
 "Catalogue of Ungulata" = "Catalogue of specimens of Mammalia in the British Museum, pt. III, Ungulata," *q. v.*
 "Cave Hunting, W. B. Dawkins, London 1874.

- Clift, W.: "On the Fossil Remains of two new species of Mastodon and of other vertebrated animals found on the left bank of the Irawadi." Trans. Geol. Soc., Lon., Ser. 2, Vol. II, p. 369.
- "Comparative Anatomy of Vertebrata" = "Anatomy of Vertebrates," *q. v.*
- "Compt. Rend." = "Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences," *q. v.*
- "Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences," Paris.
- "Contributions to the Extinct Vertebrate Fauna of the Western Territories," Leidy, U. S. Geol. Surv. Rep., Ser. 2, Vol. II.
- Cope: "Extinct Vertebrata of New Mexico." United States Geographical Survey west of the 100th Meridian, Vol. IV, pt. 2, Washington, 1877.
- "On the Extinct Species of Rhinocerotidae of North America, and their Allies." Bul. U. S. Geol. Geog. Surv., Vol. V, p. 227.
- Croiz = Croizet.
- Cuv. = Cuvier.
- Cuvier: "Recherches sur les Ossements Fossiles," Paris, ed. 1836.
- Dawkins, W. B.: "Cave-hunting," London, 1874.
- "On the Dentition of *Rhinoceros etruscus* (Falc.):" Q. J. G. S. L., Vol. XXIV, p. 207.
- "On the Dentition of *Rhinoceros leptorhinus* (Owen):" Q. J. G. S. L., Vol. XXIII, p. 213.
- "On the Dentition of *Rhinoceros megarhinus*." Nat. Hist. Rev., 1865, p. 399.
- "On the Fossil British Oxen." Pt. I. Q. J. G. S. L., Vol. XXII, p. 391.
- "On the Molar Series of *Rhinoceros tichorhinus*." Nat. Hist. Rev., 1863, p. 525.
- "Dentition and Osteology of *Elephas antiquus*," Adams. Palæont. Soc., London, 1877.
- "Dentition of Rhinoceroses (Rhinocerotidae), and on the characters afforded by the skull," Gray: Ann. Mag. Nat. Hist., Ser. 4, Vol. XI, p. 356.
- "Dentition of *Rhinoceros etruscus*," Dawkins: Q. J. G. S. L., Vol. XXIV, p. 207.
- "Dentition of *Rhinoceros megarhinus*," Dawkins: Nat. Hist. Rev., 1865, p. 399.
- "Description of a cranium of *Stegodon ganesa*," Lydekker: R. G. S. I., Vol. IX, p. 42.
- "Die Fauna der Pfahlbauten in der Schweiz." Rüttimeyer. Zürich, 1862. Nov. Mem. Soc. Hel., Vol. XIX.
- "Die Rinder der Tertiär Epoche, &c.," Rüttimeyer: Abhand. der Schweiz. pal. Gesell., Vols. IV, V, 1877-78.
- "Distribution of Animals" = "Geographical distribution of Animals," *q. v.*
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CORRIGENDA AND ADDENDA.

- Page 4, second line of note, for "1864" read "1865."
- " 5, line 12 from top, for "Davis" read "Davies."
- " 15, " 23 " bottom, for "Palæindicus" read "Palæindicus."
- " 22, " 9 " top, for "2nd Ser., Vol. III," read "1863."
- " " 4 " bottom, for "fig. 4" read "fig. 1," and on next page.
- " 23, " 4 " top, for "Plate 70, fig. 6," read "Plate LXXIV, fig. 1."
- " 24, " 12 " bottom, for "least" read "last."
- " 26, " 11 " top, for "figs. 2 and 5" read "fig. 5."
- " 31, " 13 " bottom, after the word mandible add "(Plate VI, fig. 4)."
- " 32, " 10 " top, for "molar" read "premolar."
- " 36, " 1 " " for "hysodont," read "hypsodont."
- " 40, " 10 " bottom, for "conven" read "convex."
- " 41, " 7 " " for "Plate 2" read "Plate 5."
- " 43, " 7 " top, for "*sumatranus*" read "*sumatrensis*."
- " 46, " 19 " " for "fig. 23" read "fig. 26."
- " 49, " 20 " " for "anis" read "axis."
- " 51, " 17 " bottom, for "valley" read "valleys."
- " 52, " 1 " top, for "molar" read "premolar."
- " 54, " 1 " bottom, for "hysodont" read "hypsodont."
- " 55, " 2 " top, for "hysodont" read "brachyodont."
- " 58, " 11 " " for "as" read "or."
- " " 17 " bottom, for "became" read "become."
- " 60, " 8 " top, for "hysodont" read "hypsodont."
- " 61, after line 11 from top, add "GENUS CAMELUS."
- " 63, line 19 from top, for "*elegans*" read "*navi*."
- " " 3 " bottom, for "casps" read "cusps."
- " 65, " 19 " top, for "hysodont" read "hypsodont."
- " 69, " 16 " " for "*elephas*" read "*elaphus*."
- " 70, after line 17 from top, add "DIVISION PERISSODACTYLA" (?)
- " 72, line 3 from top, for "Selonadont" read "Selenodont."
- " " after line 11 from top, add "Order Proboscidea."
- " 76, above first line from top, add "ORDER UNGULATA, DIVISION ARTIODACTYLA."
- " 77, line 15 from bottom, for "*Acotherium*" read "*Acotherulum*."
- " 78, " 8 " " for "memoirs" read "memoir."
- " 84, " 8 " top, for "Pietet" read "Pictet."
- " " lines 19 and 31, from top, for "Plate IV" read "Plate VII."
- " 85, line 18 from bottom, for "*Sibursi*" read "*Subursi*."
- " " 12 " " for "*palændicus*" read "*palæindicus*."
- " 86, " 4 " top, for "*palændicus*" read "*palæindicus*."
- " " 7 " " for "*helveticas*" read "*helveticus*."
- " 88, lines 4 & 5 from bottom, for "(Plates G and H)" read "(Plates H and I)."
- " 92. This list of Ruminants will be found amplified on page 180.
- " 93, line 6 from bottom, for "just" read "first."

- Page 94, line 20 from top, for "Mammalia" read "Mammalian."
- „ 95, „ 14 „ „ transpose "Section Selenodonta" and "Division Artiodactyla."
- „ 99, „ 1 „ „ for "vertebrate" read "Vertebrata."
- „ 102, „ 9 „ bottom, for "Perim-ganga," read "Pem-ganga."
- „ 114, „ 3 „ „ for "the following page" read "page 66."
- „ 117, „ 1 „ „ for "those" read "that."
- „ 126, „ 1 „ top, for "Mammals of Nepal" read "Genera of Indian Cattle."
- „ „ „ 2 „ „ for "*urus*" read "*priscus*."
- „ 139, „ 1 „ „ for "Perim-ganga" read "Pem-ganga."
- „ 141. The species here described as *Peribos occipitalis*, on page 174 is renamed *Hemibos occipitalis*.
- „ 145. The skull here described under the name of *Hemibos triquetriceros*, on page 177 is renamed *Hemibos acuticornis*.
- „ 148, line 20 from top, for "fig. 6" read "fig. 2."
- „ 150, Of the two skulls described as *Amphibos acuticornis*, one (Plate XXI, fig. 1) is renamed on page 178 *Hemibos acuticornis*, and the other *H. occipitalis*.
- „ 157, line 9 from top, after the word "species" add a colon.
- „ 161, Note, for "page 44" read "page 438."
- „ 167, line 6 from bottom, for "Severtgoff" read "Severtzoff."
- „ 173. Above "BUBALUS PLATYCEROS," add "Genus Bubalus."
- „ 193, line 11 from top, for "left" read "right."
- „ 258, „ 11 „ „ „ "left" read "right."

N. B.—The reader is requested to make the above corrections with pen and ink.

CORRIGENDA AND ADDENDA TO PALÆONTOLOGIA INDICA, SER. X, 2.

Molar Teeth and other Remains of Mammalia.

-
- Page 4, line 4, from bottom, for *fig. 4* read *fig. 1*, and on next page
 „ 6, line 12, from „ for *least* read *last*.
 „ 8, line 11, from top, for *figs. 2 and 5* read *fig. 5*.
 „ 22, line 10, from bottom, for *conven* read *convex*.
 „ 23, line 7, from „ for *plate 2* read *plate 5*.
 „ 31, line 20, from top, for *anis* read *axis*.
 „ 33, line 17, from bottom, for *valley* read *valleys*.
 „ 37, line 2, from top, for *hypsodont* read *brachyodont*.
 „ 40, line 11, from „ for *as* read *or*.
 „ 42, line 8, from „ for *hysodont* read *hypsodont*.
 „ 45, line 19, from „ for *elegans* read *nani*.
 „ 45, line 3, from bottom, for *casps* read *cusps*.
 „ 52, after line 17, from top, add DIVISION PERISSODACTYLA (P).
 „ 54, after line 11, from „ add ORDER PROBOSCIDA.
 „ 56, line 11, from bottom, for *of* read *in*.
 „ 58, above first line, add ORDER UNGULATA, DIVISION ARTIODACTYLA.
 „ 59, line 15, from bottom, for *Acotherium* read *Acotherulum*.
 „ 66, line 11, from „ for *Plate IV* read *Plate VII*.
 „ 67, line 18, from „ for *Sibursi* read *Subursi*.
 „ 67, line 12, from „ for *palændicus* read *palæindicus*.
 „ 68, line 4, from top, for *palændicus* read *palæindicus*.
 „ 68, line 7, from „ for *helveticas* read *helveticus*.
 Plate V. Index. Transpose, Nos. 4 and 5.

DIRECTIONS TO THE BINDER.

IN fasciculus 1 ("Rhinoceros deccanensis") substitute descriptions of Plates I, II, III, issued with fifth fasciculus (Proboscidea) for the one sheet in the first fasciculus; destroy title page and preliminary notice.

In fasciculus 2 ("Molar Teeth and other Remains of Mammalia"), destroy title page and preface, corrigenda and addenda, and appendix issued subsequently; also the page entitled "Index to plates." For Plate X in that fasciculus substitute the corresponding plate issued with the fifth fasciculus, also the descriptions of Plates IV, V, and VI.

In fasciculus 3 ("Crania of Ruminants"), destroy title page and preface, substitute for the original descriptions of Plates XX to XXIV the new descriptions issued with the fourth fasciculus, and intercalate Plates XXI A and B and XXIII A (issued with the same fasciculus) in their proper serial place; substitute reissue of Plates XXI and XXIV for original ones.

Bind title-page to volume, contents, list of plates, etc., at commencement, and index and all the plates at end of volume.

R. L.

MEMOIRS
OF THE
GEOLOGICAL SURVEY OF INDIA.

Palæontologia Indica,

BEING

FIGURES AND DESCRIPTIONS OF THE ORGANIC REMAINS PROCURED DURING
THE PROGRESS OF THE GEOLOGICAL SURVEY OF INDIA.

PUBLISHED BY ORDER OF HIS EXCELLENCY THE GOVERNOR GENERAL OF INDIA IN COUNCIL,

UNDER THE DIRECTION OF

THOMAS OLDHAM, LL.D.,

Fellow of the Royal and Geological Societies of London; Member of the Royal Irish Academy;

Hon. Mem. of Leop-Carolino Academy of Natural Sciences: of the Isis, Dresden: of the

Roy. Geol. Soc., Cornwall: Corr. Mem., Zool. Soc., London, &c., &c.,

SUPERINTENDENT OF THE GEOLOGICAL SURVEY OF INDIA.

FAUNA OF THE INDIAN FLUVIATILE DEPOSITS.

Vol. I. 1.

Ser. X. 1. RHINOCEROS DECCANENSIS, by R. B. FOOTE, F.G.S.,
Geological Survey of India.

CALCUTTA:

SOLD AT THE

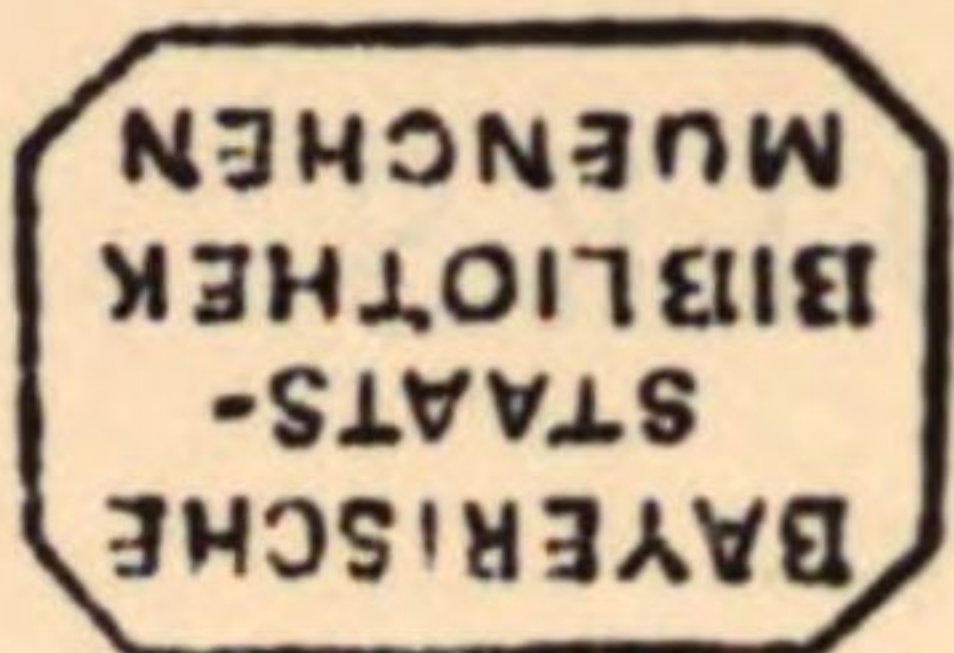
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GEOLOGICAL SURVEY OF INDIA

Geological Survey of India

REPORT ON THE GEOLOGY OF THE DISTRICT OF ...

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PRELIMINARY NOTICE.

THE Volume and Series of the Palæontologia Indica, of which this paper by Mr. R. Bruce Foote forms the first fasciculus, will unavoidably be both irregular in time of publication and without strict order, zoological or geographical. The valley-deposits, constituting the formation to which the fauna to be described belongs, have hitherto only come under cursory examination in connection with that of adjoining rock-areas, which for many reasons claim first attention from official geologists in a new country. It is likely to be long before they can be made the object of special research, and hence before anything like a full collection of fossil remains could be made, admitting of systematic and continuous description. It is nevertheless desirable to take what notice we can of so interesting a subject, and to keep the interest alive by occasional publication, whenever opportunity offers.

In fixing a title for this series our choice has not been quite free. From independent considerations—the same as regulate the decision of such questions in Europe—one would certainly characterise these fossils as the Pleistocene Fauna of India. But we have been so hampered by the application of purely palæontological standards, though of doubtful validity, that it is best to concede a right to avoid an ambiguity, several of these valley-deposits being already freely spoken of as Pliocene. The title we have chosen is quite neutral in this respect, and thereby less precise than could be desired.

The remains from these deposits in the Narbada Valley are already to some extent known through the labors of Falconer. Some notices of them have also appeared in the publications of the Geological Survey. The fact of stone implements being associated with these fossils has been recently established.

CALCUTTA: }
July 1874. }

H. B. MEDLICOTT,
Offg. Supdt., Geol. Survey of India.

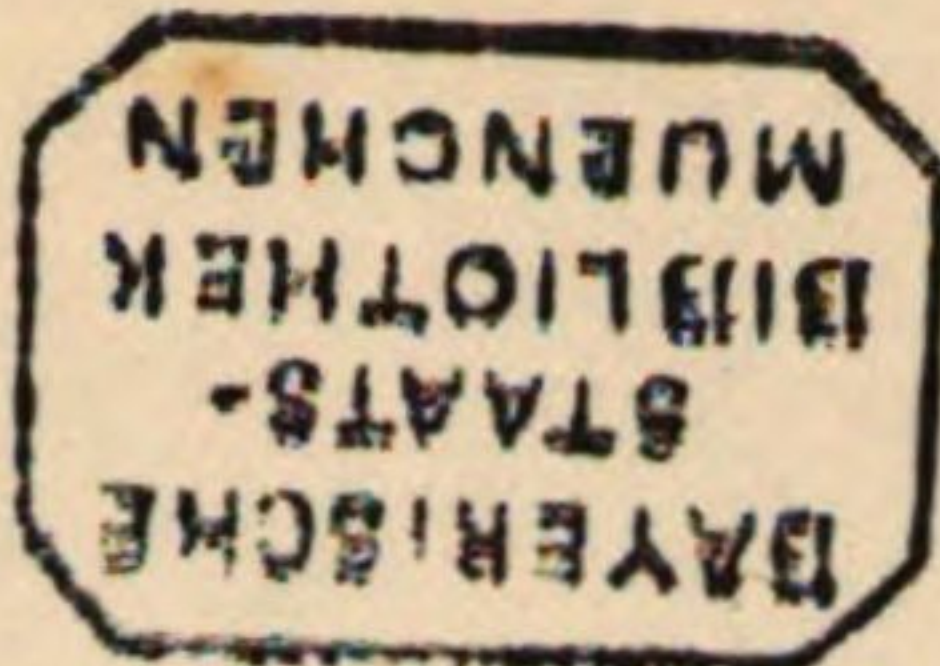
PROLOGUE

There are two things which are essential to the study of the history of the human mind. The first is a knowledge of the facts of the mind, and the second is a knowledge of the principles which govern the mind. The first is the material, and the second is the method. The material is the facts of the mind, and the method is the principles which govern the mind. The material is the facts of the mind, and the method is the principles which govern the mind. The material is the facts of the mind, and the method is the principles which govern the mind.

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THE HISTORY OF THE HUMAN MIND
BY J. H. KELLY



FAUNA OF THE INDIAN FLUVIATILE DEPOSITS.

RHINOCEROS DECCANENSIS,

A new Species discovered near Gokak, Belgaum District, by R. B. FOOTE, F.G.S.,
Geological Survey of India.

IN May 1871, while looking for sections in the bed of a small nullah, I came upon some fragments of fossil bones and teeth, and amongst them part of an upper molar of a Rhinoceros. I at once set to tracing out the source whence these bones might have been derived, and, after closely examining the banks of the nullah for a few dozen yards further up its course, found a row of large mammalian teeth exposed at a height of 3 feet above the bed of the nullah and fully 8 feet or more below the top of the bed of black clay which here forms the bank, and which black clay passes up into the typical regur of this neighbourhood. The spot at which this discovery was made lies about $3\frac{1}{2}$ miles east north-east of Gokak (a talook town in the Belgaum District, well-known from the proximity of the great fall of the Gatparba River), and about $\frac{2}{3}$ of a mile south south-east of the little village of Chickdowlee, immediately west of which the small nullah falls into the Gatparba River.

This small nullah* has cut deeply into and through the regur at that spot, and has formed a small cliff on the face of which the row of teeth abovementioned was exposed.

The rain-wash from the upper part of the little cliff had covered up everything, the teeth excepted, but on removing it carefully, I found the teeth belonged to the right ramus of the mandible of a Rhinoceros.

Beneath the rain-wash the black clay, though much broken up by sun-cracks, was hard, and the angular fragments were so closely wedged together that it required a good deal of time and trouble to remove those immediately surrounding the bones without disturbing the latter, which were not only extremely brittle, but also much comminuted *in situ* by the action of sun-cracks.

* The Chickdowlee nullah is a small stream rising in the hills to the north-west of Buneechmurdee, and not as it is represented on the map, the extension of the large nullah flowing past Kelvee, which really falls into the great Mundapoor nullah close to the village of Maldinee.

Had it been feasible I should very gladly have deferred the extraction of these bones for a day or two to do it more leisurely than was then possible; unfortunately the weather was very unsettled, numerous heavy thunderstorms had taken place within the previous week, and another was gathering at the time. Should a flood come down the nullah the greater part of the bones laid bare would certainly be swept away and lost. Then also the spot being between six and seven miles from my camp, it was impossible to keep watch over the fossil remains thus exposed, while the attention of several field labourers had been attracted by seeing me busily removing the soil with my hands, and they in their curiosity would, in all probability, have utterly ruined this valuable specimen had I left it unguarded. I decided, therefore, to take it at once as being the surest way of getting it as nearly as possible entire.

A few inches below the surface the clay became damp, but was still extremely tenacious, and it required great care and much patient labour to loosen the bones without entirely crushing them.

The position occupied by the head was suggestive of its having been drifted into its present resting-place, the heaviest part, the cranium, being undermost. The head had, however, not been entirely overturned, but originally rested on the right frontal bone and supraorbital ridge. The greater part of the right side of the head had been broken away by flood action undermining the bank. Unfortunately most of the bones thus detached and found loose in the nullah were too fragmentary to be joined together.

The left maxilla and left ramus of the mandible were in perfect apposition when freshly exposed, but the left side of the head had suffered severely prior to its entombment, as the frontal and nasal bones were missing.

The position of the left ramus in apposition to the maxilla offers a strong indication of the head, though much mutilated, not having been entirely deprived of its external covering of flesh at the time it was buried in the black clay.

No indications of any bones but such as belonged to the head were met with *in situ*, though the bank was excavated to some little depth after removing all that remained of the cranium.

Among the bones found loose in the bed of the nullah only one or two fragments appear to belong to the body of the animal, and they are somewhat doubtful.

The bones found imbedded were—

- 1.—The mandible, nearly perfect.
- 2.—The left maxilla with jugal and lachrymal bones attached.
- 3.—The squamosal bone with meatus auditorius and post-tympanic process of the left side.
- 4.—Part of right frontal bone.
- 5.—Hyoid bones?
- 6.—Pterygoid bone (right side?)

Lying loose in the sandy bed of the nullahs were parts of the right maxilla, fragments of teeth, and two or three bones too fragmentary to be determined.

When found the bones were largely covered with minutely botryoidal calcareous concretions, forming an extremely hard and dense crust irregularly distributed over the surface, in some places in large and thick patches, at others in small wart-like excrescences. From the brittle condition of the bones these were very difficult to remove without destroying the underlying surface of the bones. Many had to be gently rasped away—an operation requiring much time and patience, because of the hardness of the material.

Bones very thickly encrusted with two kinds of kunkur. Besides this botryoidal encrustation the whole surface of nearly every bone was covered by a thinner crust of a more earthy material less hard than the former. The less dense parts of this crust assimilated to common earthy kunkur, but some of the dense parts of it, which showed an arrangement in vermicular masses, though less hard, were extremely tough and fully as difficult to remove as the other form of encrustation. The removal of these crusts was, however, quite essential, as they completely hid and altered the true shape of many parts of the bones. The encrustation was by no means confined to the surface—it had penetrated most of the numerous fissures due to the expansion and contraction of the surrounding clay. These intrusions of kunkur had in many cases, particularly where they affected the teeth, given rise to total deformity of the parts by wedging them asunder, sometimes to the extent of half an inch or more. Part of the surface of many of the teeth has been eaten into, as if by a canker, by the calcareous crust resting on it, forming small shallow pits on the surface of the enamel.

The degree of alteration the bones have undergone is very various in different parts; especially is this the case with regard to the teeth, in many of which part of the enamel is perfectly preserved, while closely adjacent parts have been greatly changed and have lost all lustre and become quite mealy in texture. Excepting external discoloration from contact with surrounding soil, the bones are but slightly altered from their natural color, though a good deal of calcareous matter became infiltrated in their cancellar tissue. The enamel of the upper molars is rather browner in color than that of the lower ones. The dentine of all the broken teeth is a good deal stained along the minute capillary tubules of a deep black, apparently due to the presence of oxide of manganese. The cavities in the fangs of the teeth left by the decay of the pulp are mostly lined with acicular crystals of arragonite. The dentine was found to be traversed by innumerable minute cracks, rendering the mass extremely brittle, especially near the base of the crowns and in the fangs. Owing to this many of the teeth fell to pieces, and had to be built up by fitting piece to piece—a very long and tedious task from the great number of tiny fragments that had to be dealt with. But for the fact that the manganese stains of the dentine tubules above alluded to often formed patterns on the broken surfaces, the building up process of the dentinous parts would have been simply impossible.

Some change in the form of some of the bones has been caused by the pressure of the mass they were imbedded in. The parts principally affected by such pressure are the mandibles, the jugal arch, and the supradental portion of the left

maxilla. The mandible is materially distorted, the right ramus especially having been forced over to the left side very considerably, and the symphysis having been twisted so that the left side of the symphyseal prolongation is fully half an inch higher in level than the right. The right ramus is also rather broken at the lower edge about the middle of its length.

The upper and outer part of the left maxilla above the molar series is much crushed out of shape, so much so that the jugal arch, instead of being parallel to the side of the skull, has been turned over outwards, so that at present it has a position nearly at right angles to its normal one.

The plane of the dental series of the maxilla has also been considerably more curved than normal, the result being that the molars and premolars, instead of being in close apposition to each other as in all other species of *Rhinoceros*, are divided by spaces. This is especially observable between *premolars* 2 and 3 and *molars* 1 and 2 and 2 and 3. The bones appear to have been in a rather soft state when thus affected, else they must have been far more extensively fractured.

On comparison with all the other described species of *Rhinoceros*, both living and fossil, the head discovered at Chickdowlee shows such marked differences that it cannot be assigned to any one of them, and deserves, therefore, to be considered as a distinct and hitherto undescribed species. As such I propose to call it *Rh. Deccanensis*; and as the region in which it was found belongs distinctly to the Deccan in the older and fuller meaning of the name, and most of the other Asiatic *Rhinoceroses*, both recent and fossil, have been distinguished by geographical specific names, the one now proposed appears quite suitable.

The head only of *Rh. Deccanensis* being known, comparisons could only be instituted with corresponding parts of specimens of other species. Eight distinct points of character came specially under comparison, and they were in order of importance—

- 1.—The proportional height of the crowns of the teeth.
- 2.—The form of the symphysis of the mandible.
- 3.—The presence or absence of incisor teeth and their size.
- 4.—The special structure of the upper molar series.
- 5.—The form of the bones of the periotic region.
- 6.—The form and proportions of the zygomatic arch.
- 7.—The relative size as compared with that of other species.
- 8.—The deciduous character of premolar 1.

In carrying out the comparison of the remains of this *Rhinoceros* with those of other species, I have followed the methods adopted by the late Dr. Falconer and by Mr. Boyd Dawkins, F. R. S.,* and for the descriptive portion and plates have adopted the terms (with two exceptions) and indicative letters employed by the latter palæontologist in his several very able papers on the dentition of the *Rhinoceroses* found fossil in Great Britain.

* See Falconer's *Palæontological Memoirs* and Mr. Boyd Dawkins' papers in the *Natural History Review*, 1863 and 1864, and *Quarterly Journal of the Geological Society*, Vol. XXIII, 1867, and Vol. XXIV, 1868.

With regard to living species I have followed the latest enumeration given by Dr. J. E. Grey in the "Annals and Magazine of Natural History"* in continuation of the list published in his catalogue of the Pachydermata in the British Museum.

Unfortunately some species included among those are founded on external characters only, *e. g.*, *Rh. Oswellii* and *Rh. Crossii*, and with such, of course, comparisons were impossible.

My specimen was compared with all known published descriptions and with the fossil and recent specimens in the British Museum, the Royal College of Surgeons, London, the Jardin des Plantes, Paris, the Museum of the K. K. Geol. Reichs Anstalt, Vienna, the Imperial Museum, Calcutta, the Madras Museum, and last, but not least, the Geological Museum, Calcutta. And here I would express my sincere thanks to Mr. Henry Woodward, F. R. S., to Mr. Davis of the Palæontological Department of the British Museum, and to Professor A. Gaudry of the Jardin des Plantes, for the true courtesy with which they gave me every assistance in their power in carrying out such comparison with the specimens in their custody.

The head of *Rh. Deccanensis* indicates a smaller and slighter animal than *Rh. Indicus*, but one larger in all probability than any of the other living Asiatic species.

The head is that of a young adult animal whose permanent dentition is re-

Dental formula. presented by the formula $I \frac{0}{0} ? C \frac{0}{0}, P. M. \frac{2-3-4}{2-3-4}, M. \frac{1-2-3}{1-2-3}.$

The teeth, which were not furnished with a cement layer, are not much worn down by use; indeed, the last molars in each jaw had only just begun to show signs of wear. The animal belonged very markedly to the hypsodont section of the family.

The incisors are wanting in the mandible, and from the rather broken condition of the incisive border of the symphyseal portion, it is difficult to be quite positive whether alveoli had ever been developed there or not. The incisors, if developed there, were extremely small and quite rudimentary.

The premaxillary bones are unfortunately wanting; hence the presence or absence of incisors in the upper jaw cannot be determined, but the probability is that they were extremely small or wanting. Two fragments of bone were found loose, which present some resemblance to the anterior extremities of pre-maxillary bones in other species, and, if they should really be such, their appearance certainly disfavours the idea that the animal possessed upper incisors.

Professor Owen has pointed out that the development of the horns of the *Rhinocerotidae* is in the inverse proportion to the magnitude of the incisors. If this law held good in *Rh. Deccanensis*, it must have had a very large horn or pair of horns.† Unfortunately, however, the nasal bones were not found; so, this point remains for the present undecided.

* Annals and Magazine of Natural History, 4th Series, Vol. XI, p. 356.

† Owen's Comparative Anatomy of Vertebrata, Vol. III, p. 356.

The anterior or symphyseal part of the mandible is prolonged beyond the premolars in a narrow beak-like projection unlike in form or proportion to any species hitherto described and figured. A correct idea of its form will be obtained by referring to figures 3 and 4, Plate II. The peculiarity of this symphyseal prolongation consists in its narrowness and in the sudden diminution in width in front of the permanent premolars. *Rh. Etruscus*, Falconer, which of fossil species most resembles it, shows a less sudden constriction, if the term may be used, of the extension of the symphysis in front of premolar 2, and the extension is moreover wider in proportion. In *Rh. niger*, Gray, the symphysis is narrow, but longer than in the Deccan species, and ends in a sharp toothless incisive border. Many species of Rhinoceros, both recent and fossil, show this extension of the symphysis, but instead of its being narrow throughout its length and constricted immediately in front of the premolars, it is wide at first, then narrows, and before reaching the incisive border spreads out again in a spatulate form. In many species large or moderate sized incisors project from the anterior border. In *Rh. Deccanensis* the rather broken condition of the incisive border (*i. b.* fig. 4, Pl. II) renders it a

The mandible.

The incisors.

little doubtful whether incisors had been developed there or not. If the small and irregular cavities observable in that situation were true alveoli, and probably they were so, the incisors must have been very small and rudimentary, as has already been mentioned above. There is no trace of them left, so they had probably been shed while the animal was alive.

There are no indications of large mentary foramina like those so strongly developed in *Rh. Etruscus*.

As already mentioned (*ante*, p. 5) the symphysis has been somewhat twisted by pressure, and the right ramus has been forced over considerably towards the left one, and the central part of the lower edge rather broken. The left ramus appears to be unaffected by the pressure, but has lost the coronoid process. The

The ascending portion of the ramus.

condyle is relatively small, the transverse length of the articular surface being only 3 inches, while the same part in an otherwise much smaller mandible of *Rh. Sondaicus** measured $3\frac{1}{2}$ inches across. The curve of the ascending part of the ramus commences just below the median groove of premolar 3. The height of the ascending part of the ramus is 9.15 inches to the summit of the condyle, measured vertically from the surface the mandible rested on, or 11.75 inches, measured with a tape along the posterior edge from the condyle to the angle. From the angle to the incisive border, measured along the under side of the ramus, is a distance of 19 inches. The left ramus only was measured, being much the more perfectly preserved. The posterior edge of the ascending ramus rises almost straight, and is not notched below the condyle as in *Rh. Sondaicus* and various other species.

* In the collection of the Imperial Museum, Calcutta.

The lower molar series is represented by six normally-shaped tall crowned teeth—three premolars and three molars. Of these premolar 2, on either side, is perfect, except that the posterior wall is rather broken.

Premolar 3 is imperfect on both sides, the inner being broken away. Premolar 4 is altogether wanting in the right ramus and wants the inner wall in the left ramus.

Of the true molars in the right ramus, molar 1 is rather imperfect; molar 2 and molar 3 are perfect in the crowns; these are figured in Plate III, figs. 2 and 3. It will be observed that the posterior collis of premolar 3 had only lately begun to come into wear. The corresponding teeth in the left ramus are less well preserved. The lower molars of *Rh. Deccanensis* are not specialized, and offer no strikingly characteristic differences from many other species. The guard is but slightly developed on the anterior and posterior walls, and does not show on either the inner or outer walls in the lower molars. Molar 1 of the left side has been forced upwards and backwards by an intrusion of the encrusting matter, as shown in fig. 3, Plate II.

The annexed measurements of the lower molars may be interesting for purposes of comparison—they are as exact as the imperfect state of the specimen admitted of their being. They were made in the following directions, after Mr. Boyd Dawkins's system, at the base of the crowns:—

- 1.—Antero posterior, along outside of crown.
- 2.—Antero transverse, across anterior collis.
- 3.—Postero transverse, across posterior collis.

Tooth.	Side.	1.	2.	3.
Premolar 2	Right	1" 3"	6 $\frac{2}{3}$ "	...
Ditto 3	Left	1" 3"	...	...
Ditto 4	do.	1" 7"	...	...
Molar 1	Right	1" 8"	1" 2 $\frac{1}{2}$ "	1" 4"
Ditto 2	do.	1" 11"	1" 3"	1" 3 $\frac{3}{4}$ "
Ditto 3	do.	2" 1"	1" 3"	1" 2 $\frac{2}{3}$ "

The length of either row of lower molars on the right side is 11 $\frac{1}{2}$ inches, measured along the outer bases of the crowns.

Before passing on to the description of the much more complex upper molar series, it will be better to give a key to the indicative letters used in the plates, and which, as already mentioned, agree with those employed by Mr. Boyd Dawkins in his several memoirs. As both upper and lower molars are recognized to be formed on the same plan, though differing very greatly in the degree to which that plan was developed, the letters apply to the homologous parts in both series. The teeth are compared to a hill sub-divided by two valleys running down from the main ridge or outer wall of the tooth. Besides the subordinate hills thus formed, there are certain processes jutting from the walls of these hills into the area of the valleys, certain prominent ridges on the outer wall, certain remarkable ledges of enamel running round the sides of the walls, and certain grooves dividing the outer wall into areas, which all have to be accounted for, as their form, or presence, or absence are of great and often specific import. The comparison to a hill only

holds good to a certain extent, but it would be very difficult to find any natural object with which a better comparison could be instituted, and it has been adopted in part by so many eminent palæontologists that it is better to carry it on than introduce another, though a much better one might be found if a fortification, such as a small Indian fort or mediæval castle, were the object adopted for the comparison. The following list shows the principal parts of the teeth and the letters they are indicated by:—

- *a. Anterior valley.‡
- *b. Posterior valley.||
- *c. Accessory valley.
- *d. Anterior collis.§
- *e. Median collis.¶
- *f. Posterior collis.
- g. Anterior process=crista.
- h₁. Median process.
- h₂. Posterior process=crochet=uncus.
- i. Median groove on outer wall of tooth.
- *k. Costæ on the outer wall.
- l. Outer wall (divided by "i" into "m" and "n"). "External lamina" of Boyd Dawkins.†
- m. Anterior area.
- n. Posterior area.
- o. Guard=cingulum=bourrelet=wulst.
- p. Opening to anterior valley or "pass."

} "Combing plates" of Boyd Dawkins.

The left maxilla was found *in situ* with its six teeth, and is figured in Plate I.

The maxilla and upper molar series.

Of the right maxilla only fragments were found loose in the bed of the nullah, and from these the teeth were missing, but fragments of some teeth were also found loose. The upper molars were unfortunately more affected by decay (whatever may have been the cause), and more penetrated by the veins of encrusting matter, while the great depth of the valleys rendered them more fragile than the lower molars. Of the teeth in the left maxilla *premolar 2* and *molar 2* are much broken. *Molar 1* and *molar 3* are also considerably damaged: still enough remains to give a fair idea of this most characteristic part of the whole dentition. In both *premolar 2* and *molar 2* the outer wall is wanting.

The premolars of *Rh. Deccanensis* are specialized by the very great development of the ledge of enamel, known as the cingulum or guard (Boyd Dawkins), which occurs mostly on the anterior and inner walls of the teeth, and which is well shown in both figs. 1 and 2 of Plate I. I think I am right in saying that in no other species is this peculiar appendage of the premolars so strongly developed, and in this respect it resembles some of the European miocene species. Premolar 1 was deciduous and probably a very small tooth, as no sign of it can be made out on the edge of the maxilla. In premolar 2 a small pit,* fig. 1, Plate I, shows in the enamel ledge or

* The equivalent terms in Latin are employed by Brandt (*Rh. tichorhinus*, Mem., Acad. St. Peter, 6e ser., tom. VII.)

‡ Vallon oblique, in upper molars, Cuvier.

|| Ecorchure au bord posterieur, Cuvier; Fossette posterieur, Blainville.

§ Colline seconde, of upper molars, Cuvier.

¶ "La troisième colline," of upper molar, "le bord posterieur de la dent." Cuvier.

† Collis externus, Brandt. "Colline première qui suit exactement le bord." Cuvier.

guard on the anterior wall of the tooth; this is the only part of the building up of the teeth that I feel a shade of doubt about, because such a pit does not seem to be known in other species; the fragmentary parts, however, fitted most perfectly together. The corresponding portion of the right jaw premolar, is unfortunately unknown. This tooth is a good deal more worn than premolar 3 and 4, and the pass *p*, leading from the inner wall of the tooth to the anterior valley, is almost obliterated by wear. The edge of posterior wall of the tooth has also been so much worn that the posterior collis is separated from the posterior valley by a belt-like surface of dentine. In premolar 3, on the contrary, much less wear has taken place, and the three colles stand up distinctly. The guard commences on the anterior wall, at about one-third of the length of the wall from the anterior angle of the outer wall, and runs all round the inner wall till it merges in the posterior collis. The pass *p* dividing the anterior and median colles is deep and sharply defined. The external side of the anterior valley (*i. e.*, the side next the exterior wall of the tooth) is rather broken round the top. A spur of enamel projects from the median collis very nearly across the anterior valley, and shows that a very strongly marked crochet characterized this tooth. The posterior valley is rather oval in shape, imperfectly so however, as the curve on the posterior side of the major axis is much greater than that on the anterior side of the axis, which is parallel with the axis of the median collis. The posterior wall of the tooth descends but little from the posterior collis, and thus shows signs of wear, and also gives the posterior valley a decidedly pit-like appearance quite different from the bay-like appearance it presents in many other species, owing to the posterior wall of the tooth being deeply notched by the posterior valley. This character belongs also to the posterior valleys of premolar 2 and 4. The outer wall of premolar 3 is characterized by the anterior angle or costa *k*₁, forming an acute angle; *k*₂ the second costa is well developed, but the whole wall of the tooth is remarkable for its flatness.

Premolar 4 is, on the whole, very little different from premolar 3, though of considerably larger size. The chief difference lies in the larger proportional size of the anterior collis, which is taller and more bulging a little below the present surface of mastication. Premolar 4 is perhaps a little less worn down. The anterior angle of premolar 4 is also rather more acute. The appearance of greater height in the anterior collis of premolar 4 as compared with *premolar 3* is in measure due to the lower position occupied by the guard on the anterior half of the inner wall of the tooth. The central part of the masticatory surface is rather broken, but there is a well marked fold of enamel projecting from the median collis, *h*₂, showing that a large crochet would be present were the tooth unbroken. The outer wall of the tooth is, like that of premolar 3, remarkable for its flatness, which greatly exceeds that of all other species I have been able to compare it with. This character will be apparent from a comparison of fig. 1 in Plates I and II.

The true molars, as already stated, are unfortunately less well preserved, but enough remains to recognize many of their chief characteristics. The true molars

will be seen not to show the great development of guard which is so conspicuous in the premolars. The guards in both molars is confined to the anterior wall of the tooth, and there it occupies a much smaller space, extending less than half the length of the wall from the inner anterior angle. Moreover, in molar 1 its position is very different, as it lies very high, nearly level indeed with the crown surface of the anterior collis, upon which it rather encroaches and makes a small shelf, harp-shaped in plan, instead of a jutting ledge. In molar 2 the guard forms a wide ledge, sloping upward from the inner anterior angle nearly to the middle of the anterior; unlike *m. 1*, however, the guard springs from a point about half way down the side of the anterior collis. The anterior collis of the true molars is of much larger proportions than in the premolars, as compared with the whole size of the teeth, being very broad and stout, especially in molar 1, where it forms much more than half of the inner side of the tooth. By this increase of size in the anterior collis the anterior valley is greatly narrowed, and the pass no longer occupies a median position, and has become very narrow and much deeper than in the premolars. The crochet h_2 is very large, and all but touches the posterior wall of the anterior collis. The outer wall of the anterior valley also forms a projecting fold of enamel (h_1 , fig. 1, Plate I), which projects forward and inward. The posterior valley is unfortunately wanting, that part of the tooth being broken away, but judging from the fragment of *molar 1* of the right jaw, which was found loose in the nullah-bed, the posterior valley most likely resembled that of premolar 4. This fragment, which is figured in Plate II, fig. 2, shows a saddle-like slope descending from the posterior collis f into the posterior valley. On the outer wall of the tooth it will be seen that the anterior angle is less prominent than in premolar 4; the hinder part of the outer wall is much broken, but not too much to show the peculiar flatness described as characteristic of the premolars. The figure of the fragment of molar 1 of the right jaw above referred, was given to show the great depth of the anterior valley, which, as before remarked, is one of the special characters of the dentition of *Rh. Deccanensis*.

Molar 2, the largest of all the series, is unfortunately the least perfect, the anterior collis only remaining in tolerable preservation. The general character of this tooth can, however, be traced in plan. The form of the guard has been referred to already in the description of molar 1. The anterior collis (d) differs less from the analogous parts in premolar 3 and 4 than does that of molar 1. It is less massive in form, and does not encroach so much on the anterior valley. The median collis is, on the contrary, actually and proportionately stouter than in molar 1. The pass (p) is a shade less narrow, but would appear to have been quite as deep proportionately in the unbroken tooth. The two crochets h_1 and h_2 were, judging by the remaining lower parts (regarding the tooth as in an inverted position,) much stouter than in molar 1, but the angle at which they rise seems to indicate that they projected less into the area of the valley.

The posterior valley is smaller at the same depth than that of premolar 4, and forms a long ellipse in plan; the major axis of the ellipse being nearly parallel to

the line of the outer wall of the tooth, and far from parallel to the axis of the median collis (*e*). The outer wall is entirely wanting, and so in fact is the masticatory surface of the entire tooth, that of the anterior collis only excepted.

Molar 3, though unhappily also much damaged, is more perfect than molar 2, and exhibits the trihedral form seen in most of the *Rhinocerot*es. It had undergone but little wear at the time when its owner was entombed. This is proved by the great height of the anterior collis.

The guard occurs only on the anterior walls very much below the crown of the collis. As in the other teeth the anterior valley is extremely deep, and was intruded into a very stout and long crochet (*h*₂), the base of which is seen at some depth. The posterior collis (*f*) is represented by a little spur-like cusp (shown in figs. 1 and 2, Plate I) low down on the posterior angle of the tooth.

The teeth of both jaws are furnished with long fangs, but they were not exposed sufficiently in any case to observe any peculiarities they may possibly possess.

The thickness of the enamel varies greatly in different parts of the teeth, being thickest in the walls of the median collis and thinnest in the walls of the crochets and in the exterior walls of the anterior valleys. In the lower molars it was thickest in the outer wall, and thinnest in the walls of the anterior collis.

The length of the upper molar series measured along the edge of the crowns from the posterior angle of molar 3 to the anterior angle of premolar 2 is 10.9 inches. As before mentioned (page 6), the supradental part of the left maxillary bone is much affected by crushing, so much so that when the malar bone is placed in apposition its plane lies almost at a right angle to its normal position. The distortion is greatest above the true molars. On account of this distortion the zygomatic arch has not been figured. It forms a strong broad band connecting the maxilla with the squamosal bone by a rather flat arch. The zygomatic process is unfortunately rather broken at its base, and the connection of the zygoma with the squamosal bone therefore incomplete.

The lachrymal bone shows a well marked post-orbital projection, and the malar bone has a distinct protuberance on its upper edge opposite to the position the post-orbital process would occupy if developed in this genus.

The squamosal bone is figured in Plate III, fig. 1, in order to show the peculiar form of the groove between the post-glenoid and post-tympanic processes in which the meatus auditorius is situated, as the form of this part of the cranium in *Rh. Deccanensis* differs very greatly from many other species, as will be shown further on in enumerating the points of difference between this and other allied species.

The area between the two processes is wide and shallow at its upper part, rather deeper below the opening of the meatus; in plan it is very nearly rhomboidal. The post-glenoid process terminates in a lobe about two-thirds of an inch below its inferior junction with the post-tympanic. The latter process is greatly

thickened and protuberant near its centre. The meatus occupies the lower half of the area above defined, and is large.

The hinder edge of this mass of bone would appear to be part of the supra-occipital, possibly of the ex-occipital also, and if so, it proves that the occiput was protuberant, not concave as in some species.

The other bones found imbedded were part of the right frontal bone, the right pterygoid and two slim bones which lay between the rami of the mandible, and have a resemblance to hyoid bones, but are not sufficiently well preserved to be identified with certainty.

Rh. Deccanensis is distinguished specifically from all the brachydont miocene species, and also from *Rh. Etruscus*, by its strongly marked hypsodont character and by the non-persistency of the first premolar tooth, but it is allied to many of them by the strong development of the guard in the molar series.

It is allied to the African forms of *Rhinoceros* by the rudimentary character (or possible absence) of the incisors, but separated by the greatly elongated symphysis of the mandibles and the great development of the guard in the premolars.

There remain then the three European pleistocene species—*megarhinus*, *hemitaechus*, and *tichorhinus*—one hypsodont miocene form from Pikermi in Greece, the pliocene American form *Rh. crassus*, Leidy, and the living and fossil Asiatic species with which to compare it.

Mr. Boyd Dawkins, F. R. S., in his very interesting paper on *Rh. Etruscus*,* when speaking of the division of the *Rhinocerot*es into two classes by the relative heights of the unworn crowns of their teeth, reckons all the known living species to the hypsodont division, as also all the Asiatic fossil species. It appears to me, however, that three of the more recently established living Asiatic species—*Rh. Floweri*, Gray, *Rh. stenocephalus*, Gray, and *Rh. (ceratorhinus) niger*, Gray—show such low crowned teeth that they approach more closely to the brachydont type, and that the conclusion that this type had ceased must be modified.

Taking the different species to be compared seriatim, we find that the Deccan species differs from *Rh. megarhinus* by the narrowness of the extended symphysis, which is broad and spatulate in the latter; by the great development of the guard, which is slight in *megarhinus*; by the greater development of (k_2) the second costa on the outer wall; by the different form of the posterior valley, and by the absence of the deep notch on the posterior edge of the rami of the mandible immediately below the condyle.

From *Rh. hemitaechus* *Rh. Deccanensis* differs by the absence of the thick layer of cement found in the molars of the former; also by the different character of the molar series, for in *Rh. hemitaechus* the anterior and median colles are very narrow and compressed, and the posterior collis very low and small. In *Deccanensis*, on the contrary, the

* Quarterly Journal, Geol. Soc., Vol. XXIV, 1868, p. 214.

anterior and median colles are stout and broad, and the posterior collis, though small, attains the same level as the median.

From *Rh. tichorhinus* we must separate *Deccanensis*, because of its not possessing the thick layer of cement on the molars; because of the absence of the accessory valley "c," and because the grinding surfaces of the molars are not flat as in *tichorhinus*, but deeply excavated.

From the hypsodont miocene species from Pikermi, near Athens, described, but not named, by Professor A. Gaudry in his splendid work—"Animaux Fossiles et Geologie de l'Attique"—*Rh. Deccanensis* differs by its greatly smaller size; by the position of the guard, which is much higher up the side of the tooth than it is in the Pikermi species. In the latter the posterior wall of the tooth in *premolar 3*, *molar 1*, and *molar 2* is deeply notched by the posterior valley, which is not the case in *Rh. Deccanensis*.

The pliocene American species, *Rh. crassus*, Leidy, possesses large incisors in the lower jaw, with a broad spatulate symphysis strongly resembling *Rh. Indicus*, while the upper molar series is characterized by the presence of four valleys (anterior, two median, and posterior). Its specific diversity from *Rh. Deccanensis* is, therefore, abundantly clear.

The rudimentary character (or possible absence) of the incisors at once separates *Rh. Deccanensis* from *Rh. Indicus*, *Sondaicus*, *Sumatranus*, *nasalis*, Gray, and *stenocephalus*, Gray, but there are other distinctions also which will be pointed out separately. If I am right in my conclusion that the brachydont type is not yet extinct, *Rh. Deccanensis* would on that ground alone be separated from the remaining living Asiatic species (of which the bones are known), namely, *Rh. Floweri*, Gray, and *Rh. (ceratorhinus) niger*, Gray, as also from the fossil species *Rh. Sinensis*, Owen; but there are other distinctions also which require their specific separation.

Taking each species by itself, it will be seen that *Rh. Deccanensis* differs from *Rh. Indicus* in having only rudimentary (or no) incisors, instead of extremely large ones; also by the greater development of the guard, by the much greater relative depth of the valleys, and the much greater flatness of the outer walls of the upper molars. The rugosities at the angle of the mandible, so conspicuous in *Rh. Indicus*, are hardly at all developed in *Rh. Deccanensis*, which likewise has not the deep notch on the posterior edge of each ramus below the condyle. The broad spatulate extension of the symphysis is quite unlike the narrow beak-like form it assumes in *Rh. Deccanensis*. Then the auditory fossa on the squamosal bone is quite unlike, being broadly rhomboidal in shape in *Deccanensis* and much taller and narrower in *Rh. Indicus*. In size *Rh. Deccanensis* was certainly quite one-fourth less than the average *Rh. Indicus*, if the size of the head offers a sufficient datum to go upon in

making such an estimate. Many other minor but well marked differences might be adduced, but the above seem sufficient.

From *Rh. Sondaicus* *Rh. Deccanensis* is separated by the character of its incisors, which are very good-sized in the former. In *Rh. Sondaicus* the guard is only very moderately developed in the premolars, while the teeth are much less high crowned and show relatively much shallower valleys and very tumid outer walls instead of nearly flat ones like those of *Rh. Deccanensis*.

In *Rh. Sumatranus* we find large strong incisors, a very slight development of the guard in the premolars, and a totally different form of the auditory fossa of the squamosal bone, whereby to distinguish it specifically from the Deccan species. In *Sumatranus*, owing to the very great curvature of the post-glenoid process, the apex of the fossa lies far behind the opening of the meatus auditorius, whereas in *Deccanensis* it is very nearly vertically over it. The posterior edges of the mandible are deeply notched below the condyle in *Sumatranus*. The zygoma also is much stouter, more curved in the vertical plane, and shows a crescent-shaped excavation on its upper edge just behind the post-orbital angle—all characters absent from *Rh. Deccanensis*.

The difference between *Rh. Deccanensis* and *Rh. nasalis*, Gray, consists in the possession by the latter species of good-sized incisors and a persistent first premolar. In *nasalis* the guard is but very slightly developed, and the rami are very much slighter than in *Deccanensis*.

In *Rh. Floweri*, Gray, the teeth are decidedly less tall-crowned than in *Rh. Deccanensis*. Premolar 1 is persistent instead of deciduous, and the molar series is characterized by a very prominent development of the second costa (k_2) of the outer wall. The zygoma also is much more arched laterally than in the Deccan species, which was a considerably larger animal than *Rh. Floweri*.

A comparison of *Rh. Deccanensis* with *Rh. niger*, Gray, shows that the latter has an extended mandibular symphysis, longer in proportion than that of the former, which terminates in a narrow incisive edge not furnished with teeth and not showing any signs of alveoli. *Rh. Deccanensis* shows several small cavities on the incisive border, supposed to be alveoli, from which the existence of rudimentary (though very likely deciduous) incisors must be inferred. The mandible of *Rh. niger* is much slighter, and the ascent of the ramus does not begin till well behind molar 3, whereas in *Rh. Deccanensis* it commences at the middle of the outer wall of molar 3. The ascending portion of the ramus of *Rh. niger* is also much slighter, and is incurved along the posterior edge below the condyle instead of straight as in *Deccanensis*. The zygoma shows a well marked lunate excavation on its upper edge not found in my new species. The meatus auditorius of *Rh. niger* is narrow and leans slightly forward, and is altogether unlike that of *Rh. Deccanensis*.

It has already been shown that *Rh. Deccanensis* agrees with the fossil Indian Rhinoceroses hitherto described in being hypsodont. It differs, however, in many points which will now be enumerated.

Rh. Sivalensis, Falconer, does not show the guard on the inner side of the upper premolars, which is so marked a feature in *Deccanensis*, and both the anterior and posterior valleys are relatively much shallower. The frontal bones of *Sivalensis* are deeply incurved: in *Rh. Deccanensis* they are flat, or but very triflingly incurved. The zygoma of *Rh. Sivalensis* is not so wide in proportion to its length as that of the Deccan species.

In *Rh. Perimensis*, Falconer, the guard is also absent from the upper premolars. The anterior and median colles are much more oblique and much narrower, and the anterior valleys are much shallower and pointed at their anterior extremities, while the posterior form deep notches on the posterior wall—all points of marked difference from *Rh. Deccanensis*. The ascent of the rami of the mandible begins well behind molar 3 in *Rh. Perimensis*, and not at the median groove on the outer wall of that tooth as in *Deccanensis*. *Rh. Perimensis* was a larger animal than *Deccanensis*.

The most striking difference between *Rh. Palæindicus*, Falconer, and *Rh. Deccanensis* lies in the form of the auditory fossa, which in the latter forms a broad, shallow, roughly rhomboidal area, with the meatus opening into the lower half. The meatus itself is somewhat triangular in form. In *Palæindicus* the fossa is triangular and very small, with a circular meatus opening centrically and filling nearly the whole space between the post-glenoid and post-tympanic processes. *Rh. Palæindicus* had also good-sized lower incisors, and the prolonged symphysis, although slightly constricted in front of the premolars, expands further forward and becomes spatulate. The upper premolars did not possess a guard, and the valleys of the whole molar series are much shallower than in *Rh. Deccanensis*. The zygoma is more slender than in *Rh. Deccanensis*.

Rh. platyrhinus, Falconer, differs from *Rh. Deccanensis* in possessing large incisors and a broad spatulate symphysis. The auditory fossa is also much narrower, and the zygoma much narrower and more slender. *Rh. platyrhinus* does not show any ant-orbital wart-like rugosities as does *Rh. Deccanensis*. The anterior and median colles in the molar series in *Rh. platyrhinus* are more oblique, and the walls of the valleys much more complicated by foldings of the enamel.

Rh. Sinensis, Owen, is very distinct from *Rh. Deccanensis*. It is much smaller and distinctly brachydont; the upper premolars do not possess a guard; the valleys are very shallow, and the crochet a mere wave in the enamel wall of the median collis. Molar 3 is quadrate, rather than trihedral, in plan, and the enamel walls of all the teeth are relatively very much thicker than in *Deccanensis*.

At least three species of *Rhinoceros* appear to have been found fossil in Burmah, but have not yet been named and determined: of these one was described and figured by Mr. Clift in the Transactions of the Geological Society, 2nd Series, Vol. II, "but not named:" the other two are represented by specimens in the Geological Museum, Calcutta. *Rh. Deccanensis* differs specifically from all three. Of the animal described by Mr. Clift, two much worn left upper molars are there shown, in both of which the posterior valleys form deep notches in the posterior wall—a character not seen in *Deccanensis*. The crochets also are mere waves in the enamel walls of the median collis. The anterior outer angle of the teeth is less acute and less projecting than in *Deccanensis*. K_2 , the second costa on the outer wall, is also less prominent than in my new species.

The second Burmese species is represented by a very large and fine left upper molar,* which must have belonged to a very large animal, and far exceeds the largest tooth of *Rh. Deccanensis* in size. It is less tall crowned; has the guard well developed anteriorly, but faintly only on the inner side. A fan-shaped denticule stands at the mouth of the pass into the relatively much shallower anterior valley, and a furrow in the enamel wall descends from the anterior collis into the valley just within the pass—a feature not met with in *Rh. Deccanensis*. There is only one simple crochet. The posterior area of the outer wall is deeply concave instead of being flat, and the posterior outer angle is much less acute than in the Deccan species.

Two right upper premolars, also in the Geological Museum, Calcutta, derived from an animal considerably smaller than *Rh. Deccanensis*, represent the third Burmese species. They are characterized by the excessive development of the second costa of the outer wall (k_2) in a very median position, and relatively much posterior to the position of the moderate-sized second costa in *Rh. Deccanensis*. Two straight spur-like crochets project into the very deep anterior valleys. The more forward of the two crochets, which corresponds to h_1 in my species (see Plate I, figs. 1 and 2), is the larger, and juts out nearly at right angles to the outer wall of the tooth. The anterior and median colles are narrower and more obliquely placed than those in *Rh. Deccanensis*. It is only on the anterior side of the front tooth that any guard is shown.

At the same time that I obtained the remains of *Rh. Deccanensis*, I found, lying loose in the bed of the nullah, a fragment of a right maxilla with two teeth (probably molars 2 and 3) of a large bovine animal, allied to *Bibos gaurus*, which still lives in the Syhadri range.† The condition of the specimen and character of the encrustation covering it indicated that it came from a position corresponding to that of the *Rhinoceros* now described. In the following season, 1872, I had an opportunity

* This tooth was presented to the Geological Museum by General Sir Arthur Phayre, K. C. S. I., late Chief Commissioner of Burmah.

† The proper name of the so-called Western Ghâts.

of revisiting the locality for a few hours, and besides collecting a variety of fragments, some belonging apparently to the individual I have described, and others to a smaller but very similar Rhinoceros, I also had the good fortune to find a great part of the skull and many vertebræ of a large bovine whose teeth are identical with those obtained in 1871. As in the case of the Rhinoceros these bones broke up a good deal during and after extraction, and I have not yet had an opportunity of restoring them and determining the species of the animal.

The bovine remains were found in the bed of very dark brown clay underlying the black clay in which the Rhinoceros occurred, and intermediate between these two formations I found two thin beds of clayey grit containing numerous specimens of *Unio* ~~and *Cyrena fluminalis*~~. These shells have all been identified by my colleague, Mr. W. Theobald, as being of living species: the age of the formation they occur in, and of the overlying bed containing the Rhinoceros, may, therefore, be reasonably regarded as pleistocene. There is no record of the existence of Rhinoceroses so far south in the Peninsula of India, nor, as far as I could ascertain, does any tradition of their existence remain among the people. When the individual in question inhabited that region, the principal geological features were probably but little different from what they are now, but the general surface was doubtless covered with vast forests and morasses. Many features of the present surface indicate that various lakes or jheels existed at intervals along the valley of the Gatpurba River, formed by the damming back of the waters by several rocky barriers, which have since been worn or broken through and the lakes consequently drained.

The spot at which *Rh. Deccanensis* and the other bones were found lies well within the area of the uppermost of these supposed lakes, which was drained by the lowering of the rocky barrier, in this case of trap, which crossed the Gatpurba Valley at Tegree (Tegedi) some ten miles north-east of Gokak. The idea that this valley was occupied by a lake in former times had been arrived at quite independently by my friend Mr. A. C. Palles, c. E., from the data he obtained when carrying out a great series of levellings in connection with Government irrigation schemes in the Gatpurba Valley.

The Rhinoceros lived no doubt among the swampy valleys at foot of the Gokak hills, and its remains were drifted into the lake after its death.

SECRET

EXPLANATION OF PLATES
TO
RHINOCEROS DECCANENSIS.

PLATE I.

- 1.—View of masticatory surface of the upper molar series, left side.
- 2.—Left upper molars from the inner side.

PLATE II.

- 1.—Third and fourth upper premolars, left side, view of outer wall.*
- 2.—Fragment of first true molar, right side, showing the inner wall of anterior valley (*a*), to illustrate its great depth.
- 3.—Outer side of left ramus of mandible. Half natural size.†
- 4.—Symphysis of mandible seen from above.

PLATE III.

- 1.—Squamosal bone with meatus auditorius (*a*), post-glenoid process (*b*), and post-tympanic process (*c*);—(*d*) parts of supra-occipital and ex-occipital (?) bones.
 - 2.—Outer sides of left lower molars.
 - 3.—Crown view of ditto ditto.
- All the letters not given here will be found given at page 8.

* This view represents the teeth in their normal position, and does not therefore show their full height.

† The hindermost molar should be marked *m*₃ instead of *m*₁.

THE UNIVERSITY OF CHICAGO

to

PHILOSOPHY DEPARTMENT

STATE I.

1. The first of the two main parts of the work is the history of the philosophy of the mind.
2. The second part is the history of the philosophy of language.

STATE II.

1. The first of the two main parts of the work is the history of the philosophy of the mind.
2. The second part is the history of the philosophy of language.
3. The third part is the history of the philosophy of science.
4. The fourth part is the history of the philosophy of ethics.
5. The fifth part is the history of the philosophy of politics.

STATE III.

1. The first of the two main parts of the work is the history of the philosophy of the mind.
2. The second part is the history of the philosophy of language.
3. The third part is the history of the philosophy of science.
4. The fourth part is the history of the philosophy of ethics.
5. The fifth part is the history of the philosophy of politics.

The first of the two main parts of the work is the history of the philosophy of the mind.

[Reprint.]

PLATE I.

RHINOCEROS DECCANENSIS, Foote.

Fig. 1. View of masticatory surface of the upper molar series, left side.

Fig. 2. Left upper molars, from the inner side.



[Reprint.]

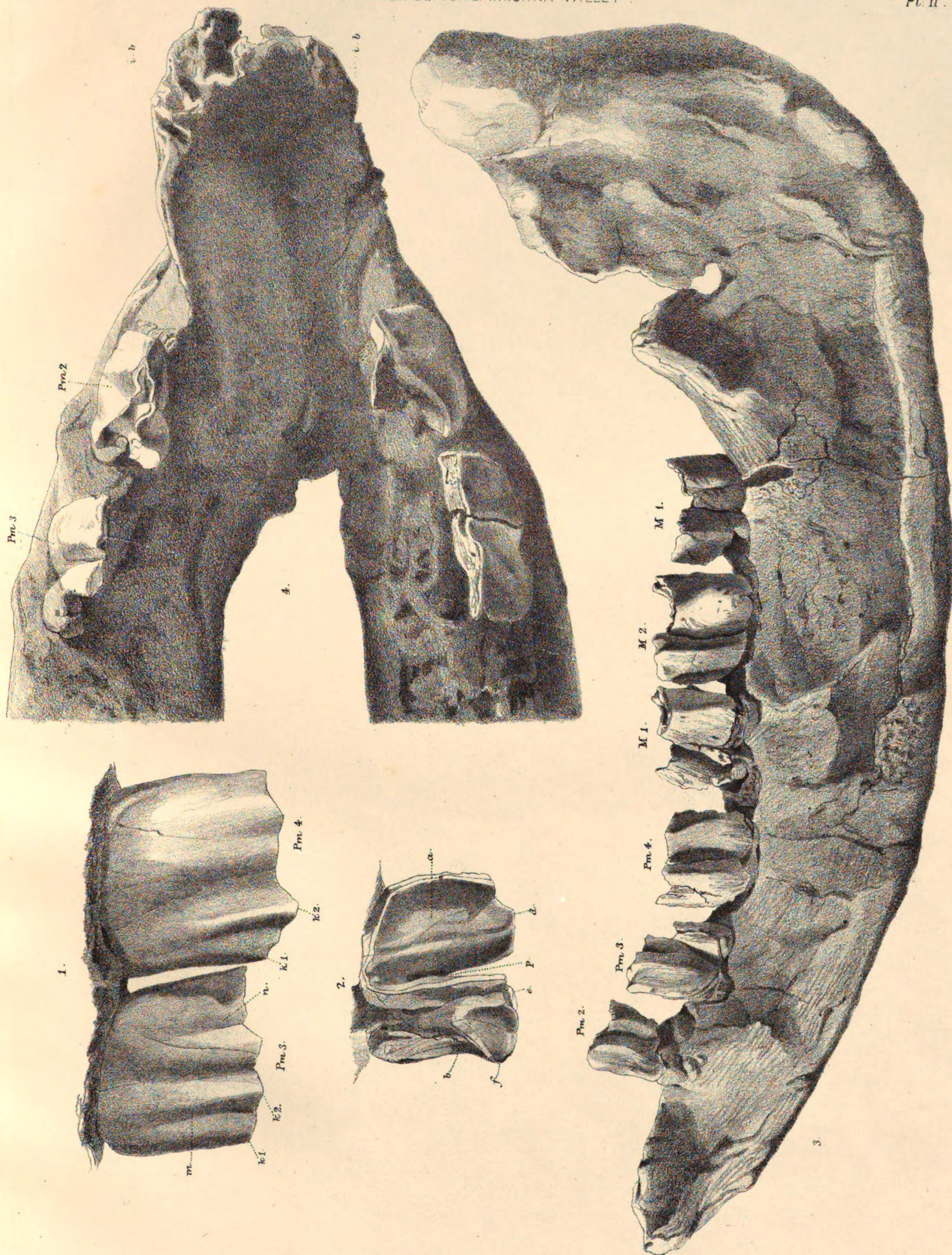
PLATE II.

RHINOCEROS DECCANENSIS, Foote.

- Fig. 1. Third and fourth upper premolars, left side, view of outer wall.¹
Fig. 2. Fragment of first true molar, right side, showing the inner wall of anterior valley (*a*),
to illustrate its great depth.
Fig. 3. Outer side of left ramus of mandible. Half natural size.²
Fig. 4. Symphysis of mandible seen from above.

¹ This view represents the teeth in their normal position, and does not therefore show their full height.

² The hindermost molar should be marked *m*³ instead of *m*¹.



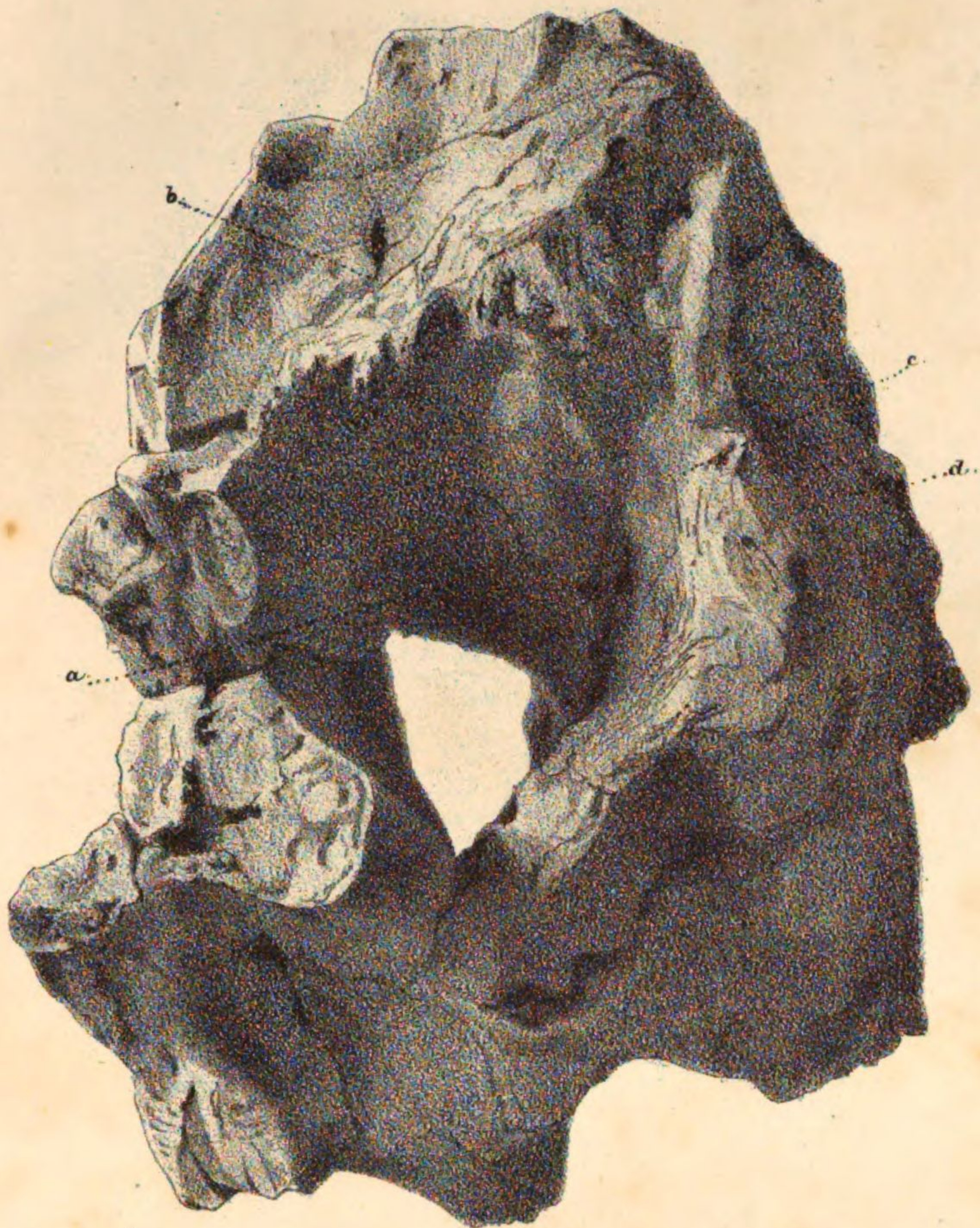
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PLATE III.

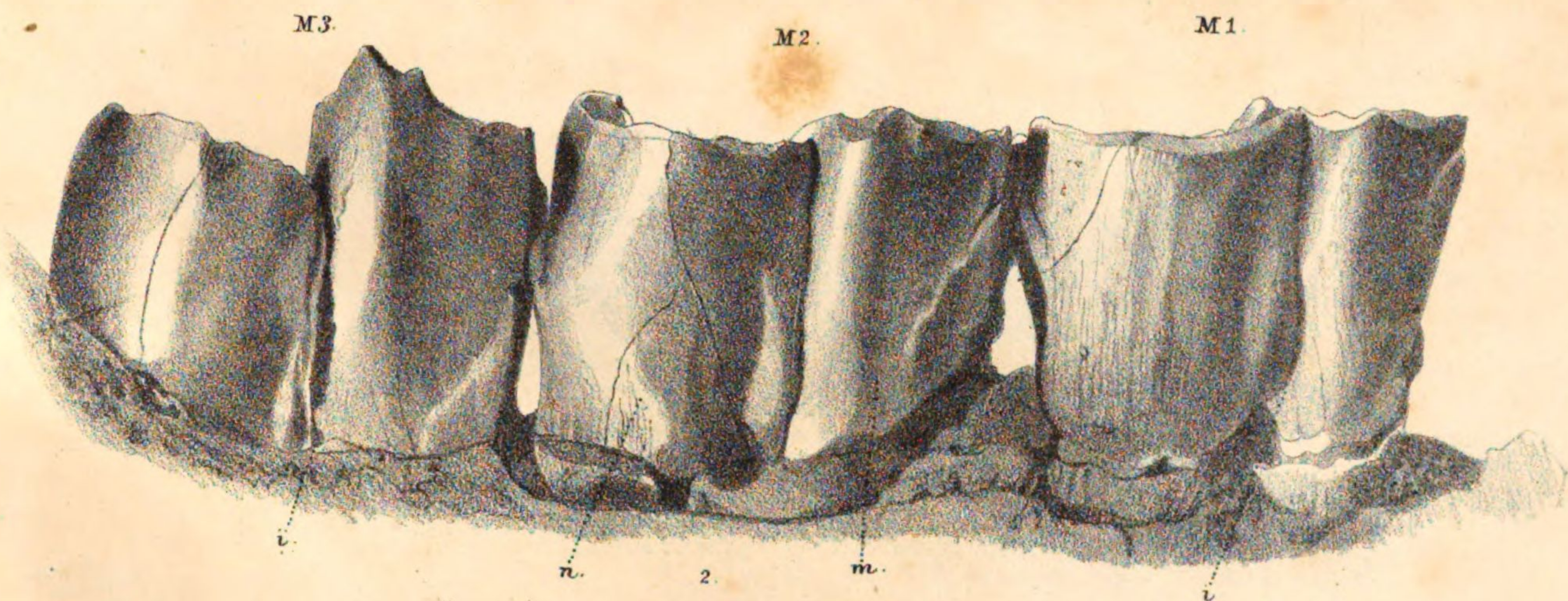
RHINOCEROS DECCANENSIS, Foote.

- Fig. 1. Squamosal bone with meatus auditorius (*a*), post-glenoid process (*b*), and post-tympanic process (*c*) : (*d*) parts of supra-occipital and ex-occipital (?) bones.
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- Fig. 3. Crown view of ditto.

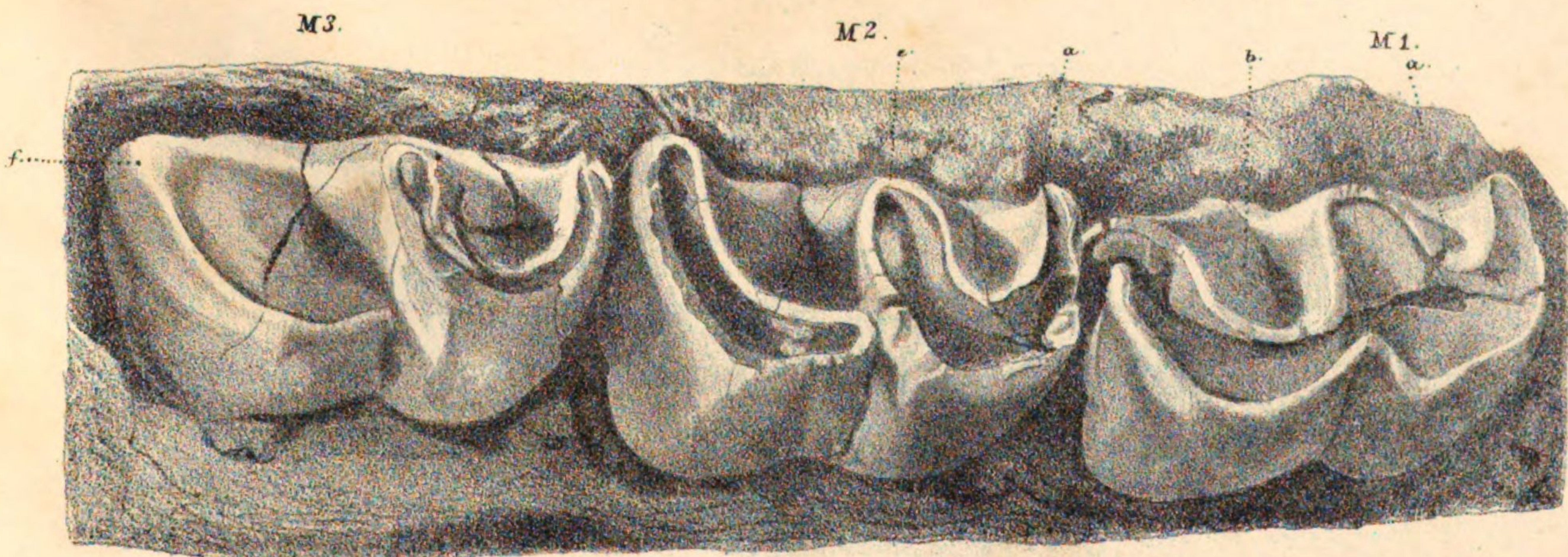
All the letters not given here and in preceding plates will be found given on page 8.



1.



2.



3.

Foote, R. Bruce

Rhinoceros Deccanensis

Calcutta 1874

4 Lith. 113 h,E-1,1/5

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